ENGINEERING SOCIETY LIBRARY, UNIVERSITY OF MICHIGAN

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK

BRANCH OFFICES AT 1750 MONADNOCK, CHICAGO, AND QUEEN ANNE'S CHAMBERS, WESTMINSTER, LONDON

EDITORIAL ANNOUNCEMENTS

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages and all of the advertisement pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Transport and Railroad Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

VOL. XXXVIII. No. 8. FRIDAY, FEBRUARY 24, 1905.

CONTENTS

EDITORIAL:

Threatened Strike on the New Haven.... 153
Degrees in Block Signal Protection..... 154
January Accidents 155
Signaling Dictionary 155
Rest for C. & N.-W. Trainmen..... 155
Record in Locomotive Erection..... 156
Change of Title, Illinois Central Officials 156
Trade Catalogues 156

ILLUSTRATED:

Missouri River Bridge of the Omaha Bridge & Terminal Railway Co. 156
Weight of Steel Railroad Bridges 159
40-ton Steel Hopper Car; London & S.-W. 160
The Grain Carriers. 160
The Chamonix Electric Railway 164
Steam Motor Cars; Great Centr. of Eng. 166
Rails for Lines with Fast Trains..... 168
Railroad Shop Tools..... 170

CONTRIBUTIONS:

The Barschall Joint. 156

MISCELLANEOUS:

Who Own the Railroads..... 158
Advertising Conditions and Requirements in the Orient. 163
The Development of Electric Traction... 166
Report Illinois R.R. and Warehouse Comm 169
Train Accidents in the U. S. in January 171
New Automatic Block Signals for the Harriman Lines..... 172

GENERAL NEWS SECTION:

Notes 57
Meetings and Announcements..... 59
Personal 60
Elections and Appointments 60
Locomotive Building 61
Car Building 61
Bridge Building 62
Railroad Construction 62
Railroad Corporation News 64

The New Haven road is now finding itself in the unusual position of a railroad threatened with a serious strike over points at issue which have no relation to any grievance of the unions against the company, and where no concessions are sought. The situation, in brief, is that the Brotherhood of Locomotive Firemen is trying its strength with the Brotherhood of Locomotive Engineers. It is not apparent that there was really any special reason why the issue should have been fought out on the New York, New Haven & Hartford in preference to almost any other railroad, except that the system is a good one for a test case because, on account of the comparatively small mileage in proportion to the importance of the business done, the firemen's organization could wield its strike weapon quickly and effectively. Besides this, it may have been thought that the fact of new management offered a good opportunity to establish precedents. The Brotherhood of Locomotive Firemen claims that the Engineers' Adjustment Committee has not been taking up with the management cases of engineers who desire to appeal from discipline unless those engineers were members of the Brotherhood of Locomotive Engineers; that is to say, the Firemen's Committee claims that if a disciplined engineer belongs to the Brotherhood of Locomotive Firemen, of whom there are several hundred employed on the road, or if he is a non-union man, of whom it is estimated that there are 150 employed on the road, the Engineers' Adjustment Committee does not act as an advocate for such an engineer as it would if the engineer who had been disciplined was a member of the Brotherhood of Locomotive Engineers. Therefore, the Firemen's Committee claims that it should be permitted to act as an advocate before the officials in the case of any engineer who is a member of the Brotherhood of Locomotive Firemen. The Firemen's Committee also claims that this privilege was granted to it by Ex-President Hall in March, 1903, and had been the practice for 18 months following that date. The controversy was appealed from the decision of the general manager to the first vice-president, and then to the president, and the officers of the road failed to find any proof to sustain the firemen's contention that such procedure had ever been the practice. The late Ex-President Hall, under date of July 28, 1904, stated that he had in March, 1903, at the written request of the firemen, heard an individual case, but denied very emphatically having made any such agreement for the future or for any other case. The company objects to the firemen's proposal on the ground that it has been a long established rule that employees who had been disciplined and who desired to take an appeal from this discipline should lay their cases before the adjustment committee of the class of labor to which they belonged, and to ask that the adjustment committee appear before the higher official as an advocate. If the firemen's committee should appear on behalf of an engineer who belonged to the firemen's organization it would necessitate that the company should distinguish, so far as its engineers were concerned, between those who belonged to the B. L. E., those who belonged to the B. L. F., and those who were non-union men, and it would also, as claimed by the Engineers' Adjustment Committee, result in a violation on the part of the company of its existing agreement with all of its engineers.

This information, somewhat elaborated and given with great detail as to facts and dates, was issued in the form of a circular by the railroad company on February 13, at which time a committee of five members of the Board of Directors had been appointed to meet Second Vice Grand Master Shea and the Firemen's General Committee. This meeting was without result, so far as a settlement of the question is concerned. According to most recent advices a plan of arbitration providing for a referring of the whole matter to a board of arbitrators composed of one representative appointed by the Firemen's General Committee of Adjustment, one by the Engineers' General Committee of Adjustment and a third arbitrator in no way connected with the company, appointed by the other two, has been agreed to by the engineers but refused by the firemen. At first glance the issue strikes the observer as being rather trivial, particularly in view of substantial proof brought forward in the shape of cases now pending to show that the Engineers' Adjustment Committee was acting in an impartial manner with regard to appearing as an advocate for engineers who were not members of the B. L. E. Moreover, it is specifically provided by the railroad company that any engineer who does not care to use a brotherhood committee as his advocate may, in accordance with Article 1 of the agreement between the company and all of its engineers, personally appear before the officers of the company and may bring with him any engineer as an advocate, regardless of whether he belongs to any labor organization or not. But the strength of the firemen's organization, apart from the numerical side of the question, lies in the fact that it is composed of younger men, and that the assessments for its provident funds can consequently be much lower, while the reserve funds remain much larger, owing to the smaller mortality of the members who share the benefits. A fireman naturally dislikes either to give up the insurance which he has for some years been paying for, or to pay a higher annual rate for the same amount of new insurance, as he would have to do if he resigned from the B. L. F. and joined the B. L. E. upon his promotion to be an engineer. It is probable that this financial consideration is the underlying motive for the strong position taken by the engineers who remain members of the Brotherhood of Locomotive Firemen in preference to joining the Engineers' Brotherhood. It is quite conceivable in such a case that the encroachment of the B. L. F. on the precincts of the B. L. E. should cause much friction, and the actual question at issue is doubtless subservient to the vital one of which union shall be the boss. The stand taken by the B. L. E. seems to be conservative and correct, and the railroad company evidently favors its position.

All that the firemen could gain in the event of a strike would be a compliance on the part of the company with their demand that their union should represent its promoted members. No wage increases or other concessions are asked, and in view of the previously mentioned general agreement between the railroad company and its labor organizations, it seems impossible that the railroad company should yield to the firemen's demand. But if the battle is long drawn out it is highly probable that ultimate victory, in one form or another, will go to the union with the greater numerical and financial strength, the Brotherhood of Locomotive Firemen.

DEGREES IN BLOCK SIGNAL PROTECTION.

In describing recently the use of the block system on certain lines of the Chesapeake & Ohio which have but a light traffic, and where the interlocking of switches and the employment of men to act exclusively as signalmen cannot be afforded, we spoke of the system as producing satisfactory results: but now comes the president of another road (whom we will call Mr. X.) using the block system in a way quite similar to that of the Chesapeake & Ohio, who seems to question our use of the term "satisfactory." Apparently he has got as good service and results as have been realized anywhere else by the use of the same methods, and he does not deny that in abandoning dependence on the space interval he has reduced his death list and greatly reduced his collision expenses; but he complains that he still has a collision now and then.

As Mr. X. does not give us the record of his collisions, or the cost of them, either before or after the adoption of the block system; and as the extreme and universal modesty of railroad officers in this matter has prevented us from getting similar statistics of other roads with which to make comparison we cannot tell him why his collisions continue to occur, or whether they do actually continue to a noteworthy extent. But it is quite clear what kinds of causes are most fruitful in producing the continued occurrence of collisions on some other roads which are very much like his, and it may be worth while to examine these causes for a moment. A president who keeps up his complaining as long as *any* collisions occur on his road is to that extent a model president; and if his complaints to his own officers have not resulted in a reasonably close approach to perfect service we shall be only too glad to cite the experiences of other roads. There must be a remedy discoverable somewhere.

We assume that the ideal which Mr. X. has in mind when he demands complete freedom from collisions is that which is suggested by the records of the railroads of England. The American ideal would be a complete equipment of automatic signals, with short block sections and well trained enginemen and firemen, neither of them overworked. But as reference is made to our description of manual signaling, we will deal with manual working alone. It is with this system that our English cousins have made their fine records. The English record, then, will stand for our theory; and for a picture of our practice we will turn to the accident bulletins published by the Government.*

On page 6 of Bulletin 13 we find two collisions, No. 2 and No. 5, due to failures of block working; a third, No. 7, due to permissive blocking carelessly carried out, and three others, Nos. 12, 17 and 21, in which the errors were of a kind which might occur under the block system. (We will not say that these are just as likely to occur under the block system, for the discipline enforced by the constant use of block signals under strict rules, and the habit of mind inculcated in enginemen by having all of the "danger points" on the road concentrated, as it were, at the ends of the block sections, are sure to improve the everyday conduct and the morale of the enginemen.) In item No. 2 the signalman was asleep. What laxity of habit had been indulged in by him, or permitted by the officers, which could cause this lapse we do not know; but it is fair to observe that in this case, as in 95 per cent. of all the block signal stations in America, the signalman probably had not had the advantage of a term of apprenticeship of suitable length. There is no question that the excellent record made by the signalmen in England is due in appreciable measure to their systematic training as subordinates before they are entrusted with a cabin. In all our reading of the English accident records we do not recall a case of a man sleeping on duty; though we do recall a case where a signalman who forgot a train had with him in the cabin a number of companions playing cards.

Collision No. 5 is like No. 2 in that the Government record does not give sufficient particulars. Neither the Federal Government nor the state in which this collision occurred provides for an investigation of such cases by competent men on the spot. Possibly the investigation of cases like this by impartial inspectors in Great Britain for more than 30 years past is an element which has materially contributed toward the records that have brought the English practice up to that high standard which we now take as an ideal.

Collision No. 7 was, apparently, a case where trainmen were allowed, whenever a permissive signal was given to them, to run —as used to be the universal fashion on prairie roads—simply by keeping the eye on the tail-end of the train ahead. That this plan does not work in time of fog, and that it is sure to entail a large percentage of minor collisions where traffic is at all heavy, is generally agreed. The only permissive signaling at all tolerable is that in which running "under control" is understood with precision by all hands and is actually practiced.

Items 12 and 21 are examples of a kind of negligence or misconduct which is found in all of the accident bulletins. Disciplining enginemen who fall asleep is difficult. They are sometimes guilty of this in cases where they have not been overworked by the company, while in cases innumerable they keep awake and attend to duty when they have been on the road 18 hours and longer. While not pretending to give out any new kind of wisdom in this connection, we are constrained to say to our complaining friend that if any of his collisions are due to this fault, he must himself take a part of the blame unless he has told his general manager to enforce, regardless of expense, a rule limiting the hours of work of his enginemen, and another rule, which can be carried out only by conscientious inspectors, to keep watch of the enginemen and see how well they use the time allowed them for rest.

Collision No. 9 occurred under peculiar circumstances. An operator was stationed at a certain point to space trains following each other, but he utterly ignored trains coming in the opposite direction. In other words, his instructions were such that he might (and did) allow a westbound train to proceed into section A B when he knew, or could have known, that a train was already in that section moving from B to A. This may seem harmless enough, but the practice of thus mixing the block system and the old system of time-tables and train despatchers' orders always contains the elements of trouble.

In Bulletin No. 12, page 4, there is one collision, No. 5, in which it may be claimed that the best provisions have failed. Possibly they have failed. An experienced runner disregarded three fixed signals and a flag. But no one has claimed absolute perfection for the block system, or for enginemen, even in England. In this case it is pertinent to observe that we have no detailed information about the character of the engineman or about those circumstances of his environment which may have affected his vigilance; nor are we informed whether or not the railroad company had adopted and was carefully carrying out an inspection of enginemen like that which has been in vogue on the Chicago & North Western and the Southern Pacific for the past year or two. Until these points are made clear no railroad president is warranted in folding his hands and concluding that such a collision as this justifies him in throwing a load of responsibility off upon the "human equation."

If the Government records were to be further searched numerous other kinds of errors and negligence would, no doubt, be discovered. Signalmen too young and inexperienced for such delicate work would be found quite common. The running of trains into yards at risky speeds would be found to be a familiar error. This is due largely to lack of systematic education of the runners to insure that they know just what the yard limits and yard conditions are at each yard, and (consequent upon this element of uncertainty) to a laxity in everyday practice which needs, but usually does not get, the constant attention of a few vigilant inspectors. The sending of enginemen over divisions with which they are not thoroughly familiar is a cause for some of the accidents which occur in yards, as well as at other places. Failure to flag in a fog is an element in the cause of many yard accidents. The flagman assumes that an approaching enginemen will come in carefully, while the engineman depends partly on the flagman. As long as we have block signaling without interlocking and distant signals, and with a deficient equipment of home signals, this class of accidents will be with us. We must not blame the block system for it.

Another class of accidents on our block-

*Bulletin No. 13, for quarter ending Sept. 30 last. See *Railroad Gazette*, Feb. 3, page 102; Bulletin No. 12, quarter ending June 30 last, *Railroad Gazette*, Oct. 28, page 498.

signaled "thin" lines is that which includes movements made under suspension of the rules. For instance, two work trains are allowed in the same block section at the same time. This may be necessary; but if so it is also necessary to see that the conductors and enginemen are of the highest competency. There is no sense in advertising your line as block-signaled and then tempting fate by sending the greenest men, with the poorest engines, into situations like this. Sometimes a freight is detained in the middle of a five-mile block and, on single track, must send a flag ahead, opposing passenger trains being allowed to flag themselves through the block or being allowed provisional rights over the freight. Flagmen will fail and enginemen will be careless and smashes will occur. Here, again, it must be clearly recognized that the block system is suspended; that we have reimposed the old conditions of danger and are bound therefore to see that we have the old quality of brains. The tradition is that in the old days our safety was due to alert and quick-witted men. The trouble is that in many cases we now arrange the conditions so that we need the quick wit but forget that that quality is a product not alone of native ability but of training in the school of experience—and we do not provide the school.

The examples which we have cited will serve to show wherein our practice falls short of our ideals. This rehearsal of well-known conditions need not be further extended, for the reader can supply variety from his own experience. It has been extended thus far merely to remind those who have not looked at the matter in this way that what may seem to be minor and secondary causes are really main causes. When we had trains meeting every now and then on the main line and completely wrecking two engines; or abusing the 5-minute time-interval and killing a rear-car-full of passengers, these causes which we are here dealing with seemed unimportant; but, with the big collisions done away with, our standards of service are unconsciously advanced; so now we find ourselves aiming to cure the evil of the lesser collisions as effectually as the worse evil has been cured. This is not to be regarded as an unattainable aim; but its attainment will necessitate a greater expenditure of care and study as well as of money than was required for the larger but simpler problem. Mr. X. is to be congratulated on his high standard. If enough presidents of similar roads adopt the same principle we shall soon have high practice as well as high standards.

January Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of January, printed in another column, contains accounts of 25 collisions, 24 derailments, and six boiler explosions. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

		Killed.	Injured.
6th.	Glencoe, Pa.	5	0
9th.	Shamokin, Pa.	2	13
10th.	Switzerland, S. C.	0	7
11th.	Piggott, Ark.	4	0
11th.	Beaumont, Miss.	1	3
12th.	Maxwell, N. Mex.	5	0
24th.	Troy, N. C.	1	6
27th.	Tullahoma, Tenn.	4	3

Runaways, like that at Glencoe on the 6th, rarely do harm to passengers and so do not enjoy the distinction of being discussed by the daily newspapers; but they merit more particular discussion by railroad officers than is accorded them at present, for with the heavy trains now everywhere common each accident of that kind is pretty sure to be costly. The Interstate Commerce Commission, acting under the law, now requires 50 per cent. of the cars in every train to be controllable by air-brakes; and this fact is often spoken of as insuring a good degree of protection against all classes of accidents which are caused or aggravated by the inability of the engineman of a train to control its speed. But there is a difference between controllable and controlled, and the question of a perfectly satisfactory way of managing freight trains in going down steep grades seems on some roads to be still unsettled. One road, at least (we do not refer to that on which this accident occurred) requires that on such grades the cars be held by the hand-brakes. Is that a compliance with the law? Presumably, the air is coupled up, giving the engineman theoretical control; but there is ground for the contention that on grades of 1 per cent. and steeper the only way that an engineman can assure himself—and the only way in which he should be allowed to "assure" the superintendent—that he actually possesses the ability to control the speed is to exercise control throughout the descent—in other words, to apply the brakes by air when they are needed.

At Piggott, Ark., four passengers were killed and their bodies burned beyond recognition. Two features of railroad practice which contributed to this disaster are very generally condemned; (1) carrying passengers on freight trains, and (2) carrying them in a vehicle heated by a stove. Certain railroad officers who have complained about the Government accident statistics have based their complaint on the alleged swelling of the passenger death list by the inclusion of those killed on freight trains; but such inclusion can hardly be termed unfair, for a person who pays for a ride cannot reasonably be classed as other than a passenger. If those who thus complain are free from censure themselves—if they never carry passengers on freight trains—their case might be met by amplifying the records and publishing two statements, one of passengers killed and injured on passenger trains and one of the same on freight trains. The true way of meeting this difficulty, however, is to provide such safeguards against collisions that passengers will be as safe in a caboose as in a sleeping-car with steel frames and a floor a foot thick.

The accident statistician never lacks for disastrous butting collisions; three of the eight accidents in the above list are of this kind. Those of the 12th and the 27th need no explanatory words. In that of the 9th, the circumstances, as reported, serve as a reminder that there is something more than fancy or conjecture in the assertion, often made, that undiscovered mental disturbances constitute an element in the cause of collisions.

The number of accounts of electric car accidents which we have found in the newspapers in January is nine, causing the death of two persons and the injury of 89.

The Committee on Definitions of the Railway Signal Association proposes further discussion of its work at the next meeting of the Association, which is to be held at Chicago March 14. It may be questioned whether that work will amount to much unless many of the definitions in words, perhaps most of them, are accompanied by pictures. It took Noah Webster 30 years to write his dictionary, and it was 20 more before the pictorial edition was published; but there is no need of taking that length of time to decide the picture question now; the need of illustrations is patent to everybody. Definitions can in most cases be made of words alone; but they are often from two to ten times as long as they need be, and correspondingly difficult to read or study. And consideration of drawings leads to the further point that this work should be done by a small committee. The committee should have in its membership enough men strong in language, and give to the work enough time, as a committee—not as individuals in cities a thousand miles apart—to do the work thoroughly; to do it so well that it would compel acceptance. Referring definitions to a gathering of the whole Association puts them in the hands of an unwieldy committee—and a committee that takes at least four months to decide anything, for each alternate meeting of the Association brings together a different set of men—first western then eastern. Accepting the definitions of the American Railway Association—the few that that Association has formulated—is worse than trying to do without pictures, for the A. R. A., in these definitions as in its rules, aimed to say as little as possible, which is not the way to make a good definition. The Signal Association wants its definitions made thorough and complete, with such brevity as may be found attainable. Now, if the reader asks why we print a half column of fault-finding on this subject, we answer that it is because we are not sure that the time is ripe for a signaling dictionary. If it is ripe we have to say, simply—what is obvious to the reader already—that the managing officers of the principal railroads, ought to give their signal engineers the thousand or two thousand dollars or more that is necessary, and have the signaling dictionary made in a satisfactory style. Perhaps the American Railway Association ought to give the money. The Signal Association is not strong enough to do it.

"On the Chicago & Northwestern they don't permit trainmen to remain on continuous duty beyond a certain time limit, and the management is receiving much commendation from the press on the subject of a recent order intended to crystalize this policy. The men are not only not required to work beyond a reasonable limit, but the man who wants to thus increase his day's earnings is restrained from doing so, and ten hours of duty is made the standard beyond which the men must not go without a reasonable amount of rest. If in case of stress, twelve hours is required, the resting period must be ten hours, and for fourteen hours on duty, twelve hours' relaxation must be taken. No engineman or trainman is allowed to go out on the road without meeting this requirement, and an elaborate checking system is employed to insure the observance of the rule."

The substance of this announcement is already familiar to readers of the *Railroad Gazette*, from its publication in these columns several weeks ago; but now it comes out in regular form from the advertising department of the road. To do the handsome thing by such an enterprising advertising agent we are bound to reprint the news; which it is a pleasure to do. It is often good to publish one's high resolves, especially in a case like this, where some grit may be required to carry them out. It is to be hoped that the C. & N. W. will have no difficulty in keeping up to its advanced standard. Compared with "making good" in this matter, the furnishing of ladies' maids on limited trains, barber shops, libraries of the world's best literature, bath rooms with imitation porcelain (metal) wainscots, and other things to tickle the passenger's fancy, is simplicity itself. Besides the avaricious train-

man, the manager must keep a watch on the trainmaster who is ambitious to make a great record in car movement; and the superintendent who, to please the brotherhoods or to avoid too many interviews with the aforesaid avaricious individual is inclined to keep his force of trainmen always too small, thus necessitating overwork. But the manager's task is by no means impossible; strength to his elbow!

What is believed to be a record in locomotive erection was recently made in the new shops of the Pittsburg & Lake Erie at McKee's Rocks, Pa. A consolidation engine which had been sent to the shop for general repairs and a new fire-box was erected and sent to the roundhouse ready to be fired up in seven hours from the time the boiler, completely stripped, was delivered from the boiler shop and placed on the frames. The boiler was set on the frames at 9 o'clock in the morning and the engine in working order was sent out of the shop at 5 o'clock on the afternoon of the same day. The work done on the erecting pit included reaming the saddle bolt holes and making the necessary taper bolts, lagging the boiler, fitting the cab and new running boards, connecting up eccentrics and valve gear and setting the valves, making all steam connections and applying cab fittings, coupling up main rods and painting wheels and front end. Ten years ago a week was not considered as an unusual length of time for doing this same work, and two weeks was often required. The tendency in all shops now is to get work through as fast as possible and make room for the next engine and at the same time get the repaired engine back into service again so that it can earn money. Fast work in the machine shop is of little value unless the other departments of the shop turn out work equally fast. The use of cranes and pneumatic tools in the erecting shop has done much to decrease the delay in assembling locomotives, but ingenuity and skill on the part of the workmen under the intelligent direction of a competent foreman count for more here than, possibly, in any other department of the shop. A record of this kind reflects credit on the designers of the shops, on the foreman in charge, and on the men themselves.

Announcement is made in another column of the change of title of Mr. W. J. Harahan from General Manager to Fourth Vice-President, and of Mr. I. G. Rawn from Assistant General Manager to General Manager, of the Illinois Central. No new position is created by this, but the former title of Assistant General Manager is dropped. In accordance with the rather unusual organization of the Illinois Central, the duties of the General Manager have much resembled those of a Vice-President. The Chief Engineer, Engineer of Construction, Bridge Engineer, etc., report direct to the Assistant General Manager, as he was heretofore called, and that officer, who spends much time on the road, is really the active, directing, head of both construction and operation. It is fitting that the breadth of his duties should be recognized in the title of General Manager, while his superior officer becomes a Vice-President. The Fourth Vice-President reports to the Second Vice-President, just as he did before the change of title.

TRADE CATALOGUES.

The Chicago & North Western.—The passenger department of this road has printed in pamphlet form Frank H. Spearman's article on the Chicago & North Western, which appeared in his work on "The Strategy of Great Railroads," the reprint is made by the permission of the publishers. A review of Mr. Spearman's book was given in these columns Jan. 27, 1905.

Bolt and Nut Machinery.—The National Machinery Company, Tiffin, Ohio, maker of bolt and nut machinery, forgings and bending machines, wire nail spike and special machinery, sends its illustrated catalogue. Detailed descriptions of machines for the above purposes are given as well as a full detailed description and line drawings of the National open die head. The catalogue is 8 in. x 10 in. and contains about 170 pages.

Railroad, Mill and Factory Supplies.—The Walter A. Zelnicker Supply Co., Fourth and Locust streets, St. Louis, is distributing a new issue of its catalogue of railroad, mill and factory supplies, heavy hardware machinery, etc. It is a large volume, containing over 800 pages, and describes and illustrates the large and varied line of supplies given above, which this company carries. There are also tables of statistics, measurements, weights, etc.

Railroad Repair Shops.—The Arnold Electric Power Station Co., Chicago, Ill., sends its bulletin No. 10, which describes in detail the equipment and the plans of the new Oak Lawn shops of the C. & E. I. R. R. at Danville, Ill. The above company acted as constructors and supervising engineers of the complete power plant, including the lighting, heating, water and compressed air systems.

CONTRIBUTIONS

The Barschall Joint.

Nice, France, Feb. 9, 1905.

To the Editor of the Railroad Gazette:

The *Zentral Organ für die Bauverwaltung*, Feb. 4, 1905, says (literal translation):

The molecular connection is lacking at the gap, without regard to whether it be transverse or longitudinal. This will never be replaced by mechanical connection with fish plates and screws, wherefore the expansions and shrinkages and the corresponding spanning and pressing tensions at the rail end cannot find an equalization.

The same idea can be expressed as follows:

The continuity of wave is confined to the length of each rail; the ending wave of one rail and the beginning wave at the next rail, succeeding each other, result in the loosening, bending or breaking of any mechanical fastening (loosening of joint ties, crushing of ballast, bending or breaking of bolts, deteriorating the bearing surfaces of bars or breaking the latter).

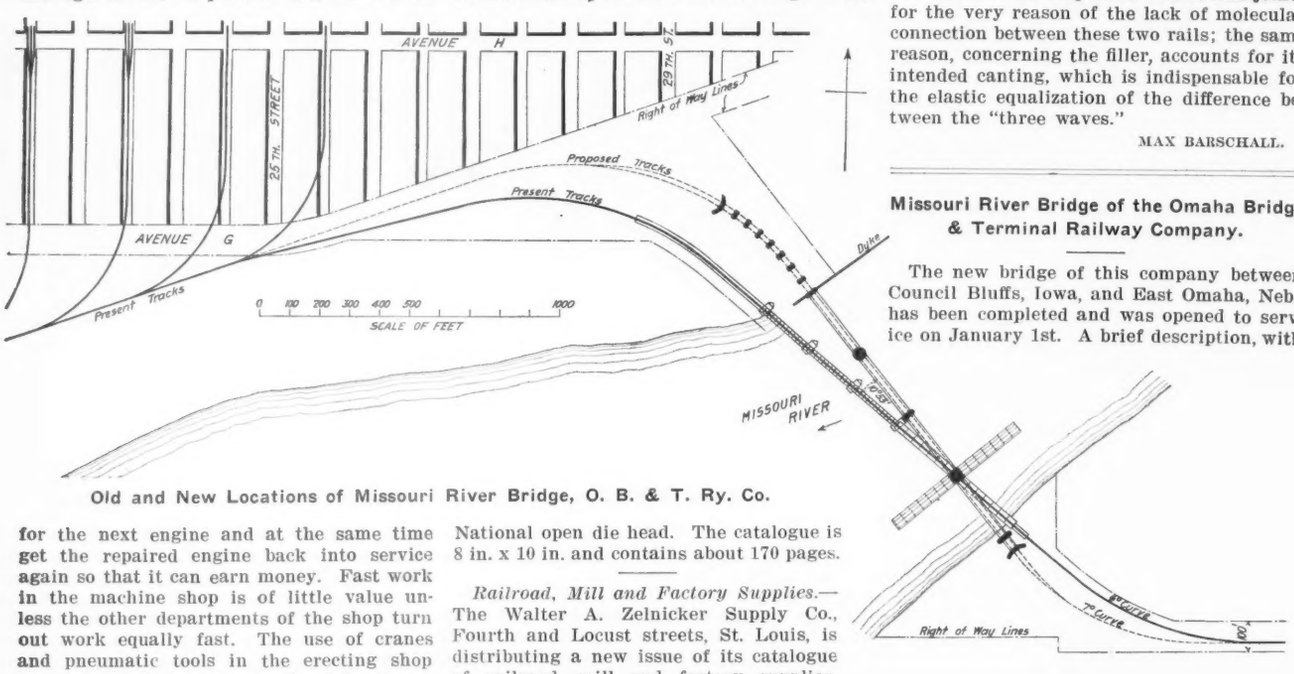
This indicates clearly that the connection must not be supported on the "waving" rail ends (head and flange), but on the joint ties, in a manner to smoothly carry the wheel on a *third* wave over the place, where the wave of the main rail is broken. Alternate joints involve the advantage of confining the interruption to one side, this advantage being increased by means of replacing the lack of molecular connection on the other side by the continuous third wave, instead of mechanical fastenings. The tire, consisting of one piece, will by means of the pressure, equalize according to shape of tread the deflection of the suspended double rail joints for the very reason of the lack of molecular connection between these two rails; the same reason, concerning the filler, accounts for its intended canting, which is indispensable for the elastic equalization of the difference between the "three waves."

MAX BARSCHALL.

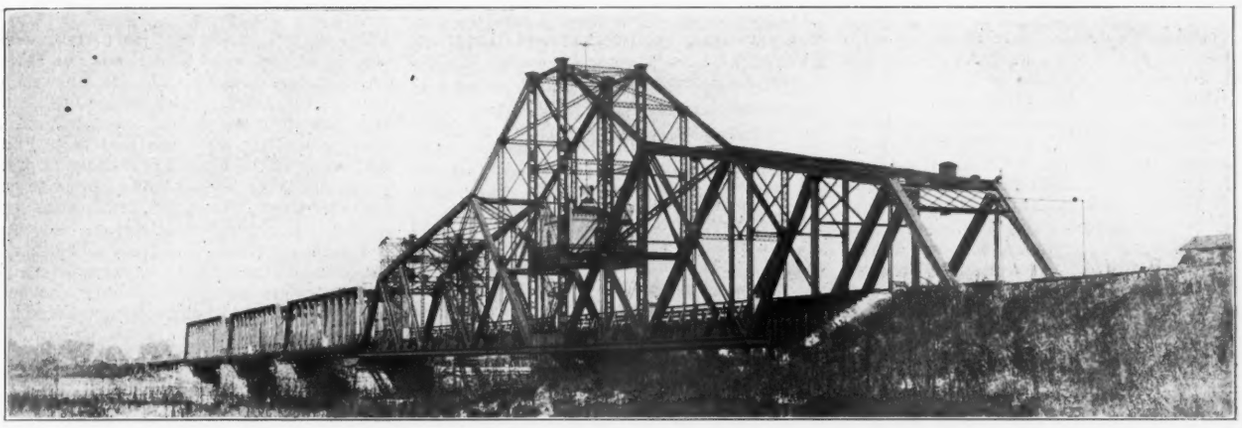
Missouri River Bridge of the Omaha Bridge & Terminal Railway Company.

The new bridge of this company between Council Bluffs, Iowa, and East Omaha, Neb., has been completed and was opened to service on January 1st. A brief description, with a general plan, an elevation and a section were printed in these columns two years ago (*Railroad Gazette*, Jan. 23, 1903). The history of the structure was given at that time, which it will be of interest to repeat briefly here.

The original bridge of this company, now controlled by the Illinois Central, was built in 1893 and was notable for the length of the draw span—520 ft.—the longest ever built. Besides this swing span, the structure consisted of three 192-ft. combination fixed spans and about 550 ft. of timber trestle approach, the swing span being the only permanent part of the structure. All of the piers except the pivot pier of the swing span were made of piling. It was thought that the com-



Old and New Locations of Missouri River Bridge, O. B. & T. Ry. Co.



Old Bridge of the Omaha B. & T. Company Across the Missouri River (From the Iowa Side).

pletion of the permanent bridge would probably be necessary in seven or eight years, but some time longer elapsed before it was actually undertaken, the temporary structure standing up better than was expected.

In order that the permanent bridge might be erected in its rightful position without interruption to traffic, the old structure was placed on a line making an angle of 10 deg. 53 min. with the line of final location, the two intersecting at the pivot pier of the swing span, as shown by the accompanying plan. Traffic was diverted from the old structure to the new simply by swinging the old draw span into line with the latter. The old draw span is 520 ft. long, center to center of end pins; depth of tower, 95 ft.; depth at end of truss, 35 ft.; width center to center of trusses, 30 ft.; center to center of tracks, 13 ft. Besides the double-track railroad inside the trusses, the span was designed to carry electric cars, highway and pedestrian traffic on cantilevered roadways outside the trusses. The temporary spans and trestle approach carried only a single track, and the roadway of the entire structure was floored to provide for highway traffic.

The final structure includes a new swing span having the same general dimensions is the first, and nine 60-ft. plate-girder approach spans, one being on the east side and the rest on the west. The new structure, with its two adjoining draws spanning the entire channel of the river, is unique. The original intention was to have a 560-ft. fixed span, but this was abandoned in favor of the swing span for two reasons, given in the article referred to at the outset:

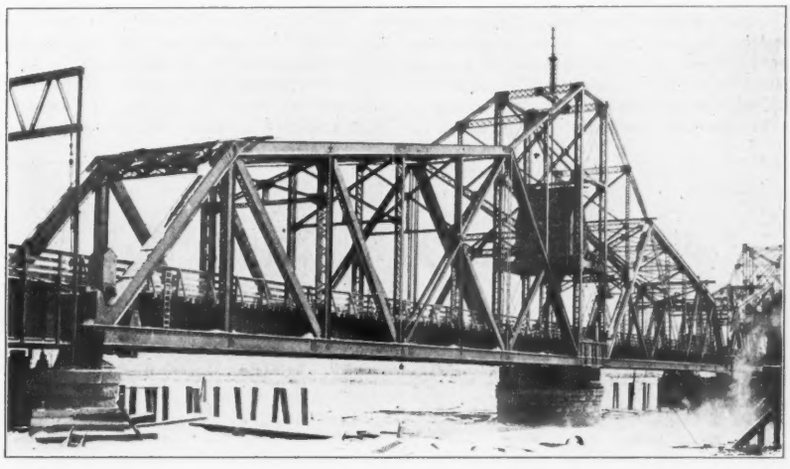
(1.) On account of the constantly changing channel of the river. It now must move outside of the present banks to get from under one or the other of the draw spans.

(2.) The cost of the additional draw and the substructure for the entire bridge on this basis was considerably less than for the structure with the fixed span.

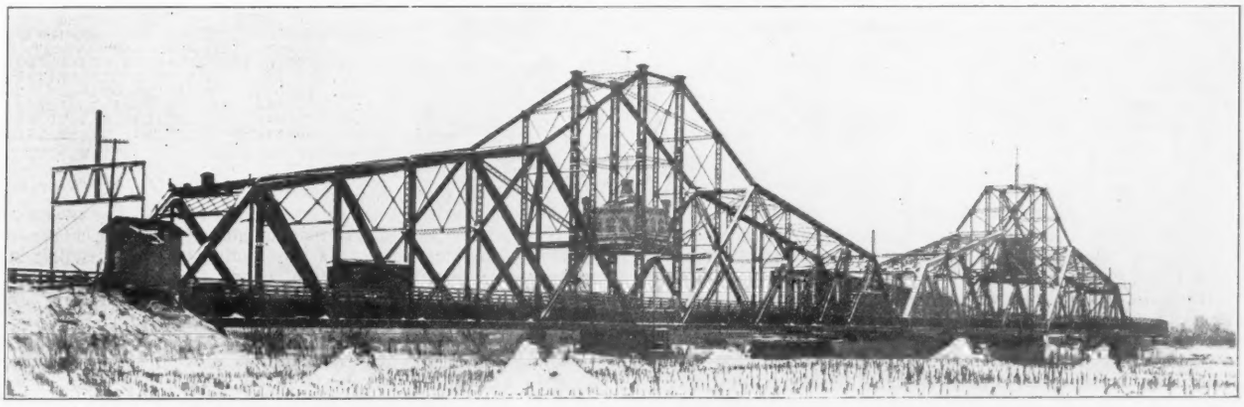
The new swing span, although having the same general dimensions as its older companion, is designed for heavier loading. The first span provided for two 110½-ton locomotives followed by 3,400 lbs. per lineal foot of bridge, while the latter loading is for two 162½-ton locomotives and 5,000 lbs. per lineal foot. The following comparison of live loads in the two spans is taken from the article of two years ago:

	Old.	New.
Live loads, per ft. of track:		
Railroad stringers	5,180 lbs.	8,450 lbs.
Railroad floor beams	4,150 "	6,320 "
Live load for trusses, per lin. ft. of bridge	9,000 "	11,180 "
Dead load for trusses, per lin. ft. of bridge	6,100 "	9,020 "

In the details of their design and construction these two draw spans present a fine example of the progress made in bridge design in the interval between their respective times of building. The new span is more than a million pounds (40 per cent.) heavier than the old, the figures being 2,768,000 lbs. and 3,900,000 lbs. respectively, which does not include the cantilevered roadways outside of the trusses, not yet built. Another important feature of difference is in the turntable, a double-webbed drum with two circles of rollers and two concentric roller tracks being used in the new design, as against a single circle of rollers and single-webbed drum in the old one. The span has eight bearing points on the drum, a cast ball and socket bearing being used at each point, constituting a new feature in draw span design. The



New Draw Span of the O. B. & T. Co.'s Bridge at Omaha.

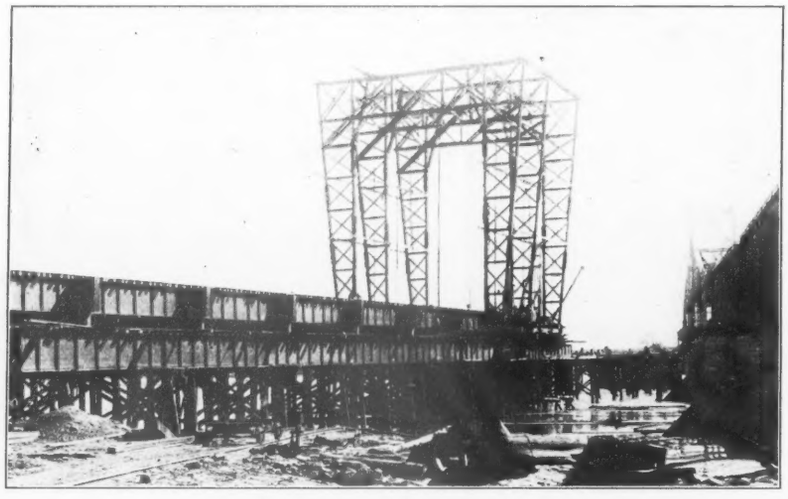


New Bridge of the Omaha B. & T. Co. Across the Missouri River (From the Iowa Side).

two circles of rollers contain 56 rollers each.

Erection of the superstructure was begun last September. A view is shown of the traveler erecting the draw span. Double-bent falsework was used, with the bents placed as far apart as possible in order to minimize the possibility of trouble from drift in case of a flood in the river. The bents were spaced to come under the truss panel points, approximately 35 ft. apart. The length of span precluded the use of a timber runway for the traveler and the outer pair of track stringers was employed. The inner pair of stringers was put in place to form a track on which to convey material.

The swing span is operated by two 35-h.p. electric motors located under the track just above the drum. The end wedges are driven by separate electric motors, placed one at each end of the bridge between the stringers. The rail locks are driven by compressed air from a small compressor in the engine house. The latter is of fire-proof construction with steel framework, concrete floors and walls of Portland cement plaster on expanded metal laths. This engine house contains the switchboard, the compressor and its reservoirs, and the interlocking machine for the bridge. The bridge is protected by four single-arm two-position semaphores set 400 ft. and 1,350 ft. on the west side, and 950 and 1,950 ft. on the east side, from the center of the new draw span. All movements of the operating machinery, signal system, etc., are controlled by the interlocking machine in the engine house, which is a combined electrical and mechanical machine. The design is such as to prevent any consecutive operation being made out of its turn. The semaphores are controlled by a separate set of levers, but all signals must be at danger before the operating mechanism can be started. The details of this interesting controlling and operating system will be given in a subsequent article. The channel is at present under the new span, so that the old span does not have to be swung.



Traveler Erecting Draw Span.

The entire substructure is new except the pivot pier of the old swing span. The new pivot pier is built of cut stone, the shafts of all river piers are concrete faced with sandstone, and the small piers and the two abutments are concrete throughout. Particulars regarding the substructure were given in the former article.

Waddell & Hedrick, Consulting Engineers, Kansas City, Mo., designed the entire bridge and supervised all work. The substructure was built by The Foundation Company, New York, and the superstructure was built and erected by the American Bridge Company. The operating, interlocking and signal appliances were designed and installed by Geo. P. Nichols & Bro., Chicago.

Who Own the Railroads.

BY H. T. NEWCOMB,
Of the Bar of the District of Columbia.

The progressive concentration of railroad control under a few great corporations and closely allied financial interests has apparently been confused, in the popular mind with an actual concentration of ownership. In other words, multitudes of otherwise intelligent people are so misled by the existence of the artificial, state-created entities known as corporations, that they fail to observe, in the backgrounds, the millions of natural persons who are the real owners of the corporate properties. The writer has recently conducted a somewhat hasty and incomplete investigation of the ownership of railroad property and has thus come into possession of statistics of unquestionable accuracy which serve in some degree at least to indicate the wide diffusion of the actual beneficial interest in the railroads of the country. This brief memorandum of the results of the investigation is prepared in the belief that it will do something to dispel the erroneous impression that railroad ownership is vested in a small group of the very rich.

As the inquiries of the present winter have dealt principally with the ownership of railroad bonds, it may be well, before stating the facts which they have elicited, to recapitulate some of the data concerning stock ownership which were made public in an article by Mr. Slason Thompson in *The World of To-day* for January, 1904.

Mr. Thompson ascertained that 43 railroad corporations controlling 115,641 miles of railroad, or less than 57 per cent. of the mileage of the country had registered shareholders to the number of 225,037. As the share capital of these railroads aggregated $3,034,495,046 it follows that the average holding of each stockholder was but $13,484. This amount does not indicate much in the way of concentration of ownership, but it does overstate the actual concentration, for anyone familiar with the real facts knows that many of the 225,037 shareholders of record are banking institutions (mostly savings banks), trust companies, insurance companies, educational institutions, executors and administrators of estates and other institutions or individuals whose ownership is of a fiduciary or quasi-fiduciary character. In addition, Mr. Thompson discovered that a single railroad, the Illinois Central, had 9,123 shareholders, of whom 7,174 owned less than 100 shares each, their average holding being less than 23 shares. Mr. Thompson's table relating to this company merits reproduction. It is as follows:

Illinois Central Railroad Company.
Distribution of shares as Registered on the Company's books at the close of business, September 29, 1903.

Holdings.	No. of stock-holders.	Shares of $100 each held.	Per cent. of entire capital.	Average holdings in dollars.
1 share to 99	7,174	164,989	17.36	$2,299.82
100 shares even	391	39,100	4.11	10,000.00
101 " to 499	1,281	270,581	28.47	21,123.64
500 " even	38	19,000	2.00	50,000.00
Total of small holdings	8,884	493,670	51.94	$5,556.84
501 shares and upward	239	456,714	48.06	191,093.72
Total of all holdings	9,123	950,384	100.00	$10,417.45

Mr. Thompson, properly, directed attention to the fact that the average annual income of the 8,884 small holders from a 6 per cent. dividend was but $333.41, while the largest holders among them would receive but $3,000 each yearly from their investments.

The present writer's investigations have been confined to the holdings of institutions which may properly be described as acting as trustees for large masses of the people. Prominent among institutions of this class are the savings banks of the country. Banks of this class are before all else the depositaries of the poor and the moderately well-to-do. The millions of patrons who entrust to them their scanty accumulations cannot directly avail themselves of the investment opportunities open to their wealthier neighbors, nor can they afford to assume the risks which are implied by promises of high returns. What they seek is safety and stability with the highest return compatible with both. The savings banks thus become an agency for the concentration of the capital of hosts of the smallest investors and the utilization of the aggregates in ways not directly open to any of them separately. Savings banks have invested very largely in railroad securities, as is shown by the following table in which statistics compiled from the latest reports of the banking departments of the six states named are presented.

Savings Banks.

State.	No. of depositors	Total deposits.	Railroad (steam) securities owned.*	Pr ct. of deposits.
N. Y.	2,365,583	$1,131,281,943	$177,444,223	15.69
N. J.	242,605	76,316,793	20,334,178	26.64
N. H.	159,956	66,140,710	23,746,521	35.90
Mass.	1,723,015	608,415,409	113,397,287	18.64
Conn.	474,548	220,597,198	82,265,024	37.29
Maine	209,011	75,107,203	25,166,853	35.51
Total	5,174,718	$2,177,859,256	$442,354,086	20.31

*Book value.

It is worth noting that the average amount to the credit of each of the 5,174,718 separate accounts represented by the foregoing table is but $420.87, and that of the security for each average deposit 20.31 per cent., or $85.48, depends upon railroad property. This means that there are upward of five million owners of railroad property whose separate holdings amount to barely $85 each.

The educational institutions of the United States have received many donations of large and small amounts which make up a vast

aggregate. This wealth they hold as trustees for the present and future generations of the young men and women of America. Upon these foundations must be erected a structure whose strength and symmetry will measure the future intelligence, progress and prosperity of the American people. And the stability of this foundation is largely bound up with the stability of railroad investments. Separate inquiries were necessary to elicit the facts concerning these investments and the results are necessarily incomplete. It has been ascertained, however, that 74 institutions of learning, nearly all of them colleges or universities but including a few secondary schools, hold greater or less amounts of railroad securities. Of these, 67 own bonds and 34 own stock; some, of course, owning both. The following data summarize the results of this portion of the investigations:

Educational Institutions.

Number represented	74
Total endowments	$142,242,079
Railroad bonds owned	43,381,318
Railroad shares owned	4,087,009
Total railroad securities owned	$47,468,327
Proportion of railroad securities to total endowments, per cent.	33.37

The valuation of the railroad securities in the foregoing is, with insignificant exceptions, that adopted by the respective treasurers in making up their balance sheets. A few institutions gave estimated values and one gave par values for bond investments only and these data have been used as reported. It is not believed that this course materially affects the result.

Various classes of insurance companies base their guarantees of protection against extraordinary losses in a large measure upon the stability of their investments in railroad enterprises. The total wealth of the American people is estimated, by the Bureau of Statistics in the Department of Commerce and Labor, at $94,300,000,000. Much of this aggregate, however, consists of real estate and other property which from its nature is not subject to the risk of destruction by fire or not insurable against fire losses. Yet the fire insurance companies which are authorized to do business in the State of Massachusetts (the list probably includes all of the larger companies but undoubtedly excludes many small concerns whose business is confined to the localities in which they exist) have now in force fire policies in the aggregate amount of $26,083,790,625. Who can doubt that the protection afforded by these policies is so widely diffused as to include all but a relatively negligible proportion of the owners of insurable property? Who can doubt that this protection extends to almost all the farm houses and small homes of the country? The railroad securities owned and held as collateral by the fire insurance companies investigated are shown below:

Fire Insurance Companies.
(Those authorized to do business in Massachusetts.)

Amount of policies in force	$26,083,790,625
Railroad securities owned:	
Shares, No.	281,458
Shares, book value	$30,157,552
Bonds, Book value	83,545,341
Total, book value	$113,702,893
Railroad securities held as collateral:	
Shares, No.	13,897
Shares, market value	$1,074,881
Bonds, market value	674,871
Total, market value	$1,749,752

When it is realized that the aggregate assets of the companies included in the foregoing statement amount to $393,148,697, it must be evident that the security which they afford would be seriously impaired by any successful attack upon railroad values. Leaving out of the account the railroad bonds and shares which they hold as security for loans, those of which they are the actual owners amount to 28.92 per cent. of their entire assets. It follows that of the $26,083,790,625 which represent the fire risks covered by insurance no less than $7,543,432,249 depend upon the stability of railroad values.

The accident insurance and guarantee companies authorized to do business in Massachusetts are also large owners of railroad securities. The following data relate to these companies:

Accident and Guarantee Companies.
(Those authorized to do business in Massachusetts.)

Premiums in force, annual rates of	$32,808,135
Railroad securities owned:	
Shares, No.	54,408
Shares, book value	$4,840,662
Bonds, book value	10,915,587
Total book value	$15,756,249
Railroad securities held as collateral:	
Shares, No.	1,740
Shares, market value	$30,815
Bonds, market value	5,150
Total, market value	$35,965

The life insurance companies of the country constitute the largest class of investors in railroad property. Through them vast numbers of American citizens protect their families more or less completely against the financial difficulties that too often add want and privation to the natural sufferings that inevitably attend death. Through them the dependent members of millions of families are the actual beneficial owners of hundreds of millions of railroad property.

There is one form of life insurance which appeals exclusively to wage-earners and other persons whose incomes are very moderate. It is known as "industrial" insurance because it is particularly in the ranks of the manual workers that its agents expect to find its patrons. Six companies now write policies of this class and their policy holders number no less than 13,789,186, while the aggregate of their policies is $1,894,811,287. These companies own bonds of steam railroads to the amount of $50,236,742 and shares to the value of $2,011,294. They hold as collateral for loans railroad bonds worth $1,124,645 and shares worth $605,600. The following table includes all classes of life insurance:

Life Insurance Companies.
(Those authorized to do business in Massachusetts.)

No. of policy holders:	
Ordinary	4,358,196
Industrial	13,789,186
Total	18,147,382
Amount of policies in force:	
Ordinary	$9,121,600,341
Industrial	1,894,811,287
Total	$11,016,411,628
Railroad securities owned:	
Shares, No.	432,126
Shares, book value	$48,661,655
Bonds, book value	619,601,241
Total, book value	$668,262,896
Railroad securities held as collateral:	
Shares, No.	259,670
Shares, market value	$21,878,199
Bonds, market value	24,503,084
Total, market value	$46,381,283

The assets of the companies represented in the foregoing statement aggregate $2,128,131,253 so that the railroad securities owned, excluding those held as collateral, amount to 31.40 per cent. of the total security for the payment of their policies.

A recapitulation of the data in regard to insurance companies follows:

All Classes of Insurance Companies.
(Those authorized to do business in Massachusetts.)

	Railroad securities. Owned.	Held as collateral.	Total.
Shares: No.	767,992	275,307	1,043,299
Value	$83,659,869	$22,983,895	$106,643,764
Bonds, value	714,062,169	25,183,105	739,245,274
Total	$797,722,038	$48,167,000	$845,889,038

The extent in which the business life of the nation is based upon railroad values and the diffusion of railroad ownership may be summarized, so far as they are disclosed by the present investigation, by the following table:

Value of Railroad Securities Held.

By insurance companies investigated	$845,889,038
By the savings banks investigated*	442,354,086
By the educational institutions investigated	47,468,327
Total	$1,335,711,451

*Six states only.

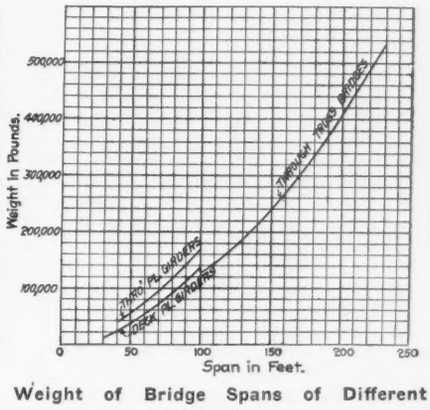
Who can doubt that complete returns from these three classes of institutions would show that they hold more than one and one-half billions of railroad property?

On Feb. 24, 1903, the Interstate Commerce Commission reported to the Senate the market value of the railroad securities of the country and its report has been published as Document No. 178 of the Fifty-Seventh Congress, Second Session. This report shows that taking the average market values of March 31, June 30, Sept. 30 and Dec. 31, 1900, and applying this average to the bonds and shares outstanding on June 30, 1900, the aggregate market value of the railroad securities investigated was $8,351,103,523 plus some allowance for $812,066,859, in par value, of securities the market value of which was not ascertained. Assuming that the book values reported by the various concerns covered by this investigation are fairly conservative they should be comparable, roughly at least, with the market values of the year 1900. If this is so it would appear that the present investigation, hasty and incomplete as it has necessarily been, has disclosed the location of the beneficial ownership of about one-sixth of the railroad property of the country. And the beneficial ownership thus disclosed is not concentrated in the hands of the wealthy but represents the savings of the farmers, the artisans, the small dealers, and other citizens whose incomes are moderate and whose savings are small.

Weight of Steel Railroad Bridges.

BY H. G. TYRRELL,
Ch. Engr. Brackett Bridge Co., Cincinnati.

Up to within a few years ago bridges designed for a load corresponding to Cooper's E 40 specification were considered amply strong, but at the present time many railroads are renewing bridges built for this



Weight of Bridge Spans of Different Lengths.

loading with heavier structures proportioned to carry locomotives weighing from 170 to 180 tons followed by a uniform load of 5,000 lbs. per lineal foot of track which is the equivalent of Cooper's E 50 loading. Even greater loads have been used in designing some of the largest bridges, notably the Wabash bridge over the Monongahela at Pittsburg.

The accompanying weight curve has been

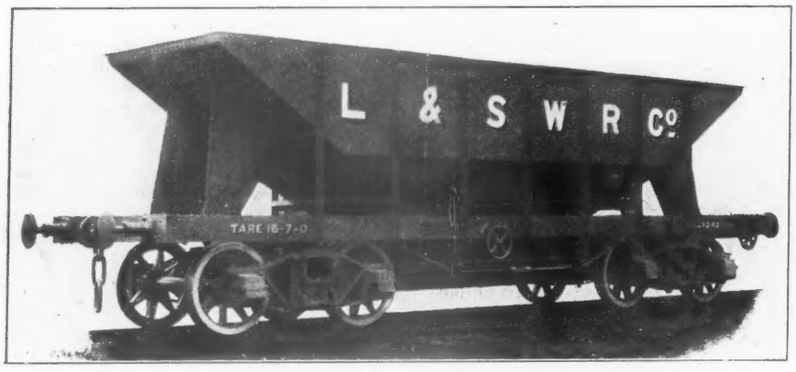
plotted to show the approximate weight of single-track, steel railroad bridges for spans from 30 ft. up to 230 ft. to carry loads equivalent to Cooper's E 50 specification. The curves are plotted for through and deck plate girders up to 100 ft. span and for through trusses for spans greater than 100 ft. The formulæ used are as follows:

Deck plate girders..... $W = 100 + 12\ L.$
Through plate girder..... $W = 500 + 12\ L.$
Through truss spans..... $W = 600 + 7\ L.$

In the above equations W is the weight in pounds per lineal foot of single track bridge and L is the span in feet. For double track bridges the weight is about 90 per cent. greater than for single track structures of the same span.

Forty-ton Steel Hopper Car for the London & South-Western.

The accompanying illustration shows one of 16 steel hopper ballast cars of 40 tons capacity recently built for the London & South-Western by Messrs. G. R. Turner's Vulcan Ironworks, Langley Mill, Nottinghamshire. These cars are for use in hauling ballast from the company's extensive stone quarries near Okehampton. They are 32 ft. long over end sills, 9 ft. 9 in. high from rail to top of side, 28 ft. long inside, and 7 ft. 5½ in. wide inside, giving them a cubic capacity of slightly more than 32 cu. yds.



40-Ton Steel Hopper Ballast Car, London & South-Western.

The underframe is composed of 10-in. channels with truss rods under the side sills. The body is supported mainly by the center sills between the bolsters, part of the load being transmitted to the side sills by the T-iron side stakes. The usual end posts are entirely omitted and the overhang of the box is supported by two wide plates which are carried down to the center sills between the bolster and end sill. Plate knee braces are built up from the floor to the top of the sides on the inside of the box to hold the sides against bulging. The hopper door delivers the load between the rails and is opened and closed by a hand wheel on the side of the car operating a worm and screw gear.

The cars are mounted on diamond arch bar trucks with 37-in. wheels and 5-in. x 10-in. journals. Automatic vacuum brakes and a powerful hand screw brake are applied and the usual form of spring buffer and chain and hook draft and buffing gear is used. The tare weight without brake rigging is 36,600 lbs.

The Grain Carriers.

The accompanying map, published by courtesy of Peter Wright & Sons, Philadelphia, shows with exceptional clearness the location of and the territory reached by the grain carrying railroads in the United States and Canada. During the last few years the sharp competition of the Gulf lines for this grain business has changed radically the current of the movement, with a result that there have been constant grain rate wars between the Gulf lines and the trunk lines, and a long and unsettled contest over differentials between the Atlantic ports that are feeling the effects of the diversion of the traffic, and view each other's respective claims with suspicion. The primary reason for the great increase in recent years of tonnage to the Gulf and to the Canadian lines is, of course, the fact that the central part of the country, formerly the chief grain raising area, is becoming rapidly built up and the grain acreage there has consequently been decreasing steadily, while the comparatively open territory in the Southwest and in the Canadian Northwest now grows by far the greatest grain crop. The secondary reason for the diversion of grain from the trunk lines is the great activity of the lines running to the Gulf, which have realized for some time that they possessed the best route for handling the southwestern grain, provided proper ocean communications could be established.

As has been pointed out in previous articles, New York, by the very fact of its being the chief import city in the country, has a very large natural advantage in the grain export business. The rates at which export grain are carried naturally divide themselves into two heads: cargo rates, where a whole ship, or substantially a whole ship, is chartered for the trade, and berth rates, where a ship carrying a general cargo has a greater or less amount of extra room available. Grain is a very convenient cargo for such a ship to fill up with, requiring no handling or stevedoring in the berths to which it is assigned, and it therefore follows that export rates are pretty sure to be kept lower by this competition of berth rate business from a port where there are a large number of steamers engaged in miscellaneous traffic. New York is so easily pre-eminent in this respect that a low ocean rate can always be assured. Moreover, it has the advantage of regular lines of steamers running not only to the principal European grain market ports, but also to many other European and Asiatic ports where there is likely to be a temporary demand for grain if the ocean rates can be made low enough, and there is no doubt that this fact alone will always suffice to insure a large grain movement to New York. The same thing is true in a measure of Boston and Philadelphia, and to a less degree of Montreal and Baltimore. The total flour and grain receipts at New York in 1903 amounted to 125,069,546 bushels (flour expressed in bushels). Of this total, 59,988,057 bushels came by the all-rail route; 51,441,582 bushels by lake and rail; 12,900,100 by canal, and 739,807 by river and coast. The following table, from the New York Produce Exchange statistics, shows the division of this traffic among the New York carriers.

Bushels (including flour), 1903.

	All rail.	Lake and rail.	Total.
N. Y. Central	15,738,322	12,749,461	28,487,783
West Shore	12,565,582	16,349,074	28,914,656
Erie	7,669,336	7,781,571	15,450,907
Penn.	7,576,727	1,317,582	8,894,309
D., L. & W.	2,967,892	4,268,238	7,236,130
Lehigh Valley	10,195,525	8,975,656	19,171,181
Balt. & Ohio	1,602,870	.....	1,602,870
Others	1,671,803	.....	1,671,803
Total	59,988,057	51,441,582	111,429,639

Within recent years a considerable general foreign traffic has been built up at New Orleans, and the railroads making it their terminus, particularly the Illinois Central with its magnificent Stuyvesant docks, have done all in their power to foster this business; but it still remains true that practically all the ocean tonnage running to New Orleans is interested primarily in the exports from that point rather than in the imports which it brings there, so that the attractive chances for grain charters at berth rates are not as numerous as they are on the Atlantic seaboard.

But, taking Kansas City as the real export center for southwestern grain at the present time, the schedule of trunk line distances and connections on page 162 also prepared by Peter Wright & Sons, shows that the railroad mileage from this point to the Gulf ranges in the vicinity of 900 miles, which is approximately the same as the distance by the most direct route from Chicago to New York, the haul from Kansas City to Chicago representing the advantage in favor of the Gulf ports. Moreover, the most direct route from Chicago to New York, the Pennsylvania, is one of severe grades and of congested traffic, whereas the south and southeastbound grades from the southwestern grain country to the Gulf are easy.

If the grain goes via Buffalo by the combined lake and rail route it has low grades but a considerably greater mileage. New York is at a similar disadvantage with regard to the northwestern and Canadian grain. From Duluth to Montreal by way of the Canadian Pacific is 1,042 miles, and from Chicago to Montreal the distance is approximtely 840 miles by the C. P. R. and by the Grand Trunk. From Duluth to Boston is 1,400 miles via the Canadian Pacific. During the season of open navigation the deep water Canadian canals in connection with the St. Lawrence route, with the comparatively short distance of restricted canal prism, offer a

	Wheat, flour, barrels.				Wheat, bushels.				Corn, bushels.			
	1897.	1899.	1901.	1903.	1897.	1899.	1901.	1903.	1897.	1899.	1901.	1903.
Boston	1,208,731	1,528,257	1,496,163	767,044	9,592,108	11,567,847	17,910,887	2,867,994	9,424,644	17,337,608	10,331,712	6,627,107
Philadelphia	815,181	2,101,435	2,237,527	2,664,177	4,804,606	4,013,927	11,230,785	1,600,790	24,140,487	29,458,334	15,793,304	9,994,838
Baltimore	2,325,803	3,367,485	3,324,953	3,489,618	15,304,039	9,549,270	19,962,737	3,160,614	43,048,008	46,786,127	24,711,790	19,113,566
Newport News	1,487,828	1,726,128	2,757,839	1,044,044	1,465,465	503,897	4,785,596	334,448	16,772,539	14,170,131	3,172,573	3,535,966
New Orleans	345,017	465,910	688,222	1,374,344	10,356,248	11,562,812	24,410,979	11,989,273	24,714,472	21,939,586	12,832,139	13,332,203
Galveston	49,892	171,674	143,673	588,516	7,355,636	15,713,400	15,714,465	20,039,633	4,073,021	7,044,697	.....	4,274,091
Montreal	585,813	1,080,459	524,494	1,045,631	9,899,308	9,852,125	13,594,686	15,871,969	9,210,222	13,272,602	4,059,790	6,811,590

route much more economical than either the present Erie canal or the proposed barge canal can offer. The portion of the Canadian route which is canal only amounts to about 86 miles, and it admits boats of 2,200 tons, while the canal portion of the proposed New York barge canal is approximately 320 miles long and admits boats of only 1,000 tons gross.

The table on page 160, compiled from the statistics of the New York Produce Exchange, shows the comparative exports of domestic flour and grain from the principal ports in 1897, 1899, 1901 and 1903.

Since December 29 there has been a rate war of unusual severity between the lines to the Gulf and the trunk lines to obtain the tonnage of the southwestern grain. It must always be kept in mind that the strength of the western lines in such a conflict lies in considerable part in the fact that they get a high local rate to the primary point as collectors of the grain before the application of the low competitive through rate. It is obvious that the trunk lines, which get only a low through rate, cannot afford to carry the traffic at a loss for any length of time with no increased local collections to reimburse them. The rates in effect prior to Dec. 29, 1904, on corn for export, were as follows:

From	To	Per 100 lbs.
Omaha	Gulf ports	18c.
Kansas City	Gulf ports	17c.
Omaha and Kansas City	Baltimore	24c.
" " " "	Philadelphia	24½c.
" " " "	New York	25½c.

On December 29 the Missouri Pacific Railway adopted the following rates:

Omaha to Belfast*	27.5 to 28.33c.
" " Copenhagen	28.33" 27.92c.
" " Norresundby	29.17c.
" " Odenso	28.75c.

(Covering 1,004,208 bushels.)

*Via Westwego, a suburban station in New Orleans where elevator for handling export grain via New Orleans is located.

It is the presumption that the inland proportion of the through rate was materially reduced from the rates first quoted above as in effect prior to December 29th from Missouri river points named to Gulf ports. Just how the through rates to the foreign ports were divided the tariffs do not disclose.

Jan. 28, 1905, the M., K. & T. issued a tariff making the rate from Kansas City to Galveston 12½c. per 100 lbs., a reduction of 4½c. from the rates in effect prior to Dec. 29, 1904. The other Gulf lines immediately followed the reductions of the M., K. & T. from Kansas City and established rates from Omaha 1c. higher, or 13½c. per 100 lbs.

The reduced tariffs named above were issued without advice to any of the lines running to Atlantic ports via upper Mississippi river crossings or Chicago. The question of adjustment of rates on grain originating west of the Missouri river has been the subject of controversy between the Gulf lines and the lines running eastwardly from Missouri river to Atlantic ports for several years. Demands have been made for the establishment of an equitable correlation of rates as between the Gulf ports and the Atlantic ports so as to insure a fair division of the export grain business as between the two gateways. No adjustment has ever been made that has been satisfactory or that has secured anything like a uniform or equitable movement of the business. It has been entirely spasmodic, and when the Gulf lines have desired to move a certain amount of tonnage a rate was made regardless of any fixed correlation as shown by the tariffs that have been assented to and established for the purpose of experiment.

The lines running from the Missouri river to the Atlantic ports were never able to follow the reductions made to the Gulf ports because they were confronted either at Chicago or at the Mississippi river with arbitrary rates, thence to tidewater, and there have been times when, if the lines from the Missouri river to the Mississippi river carried the business for nothing, the rates east of the Mississippi river were such as to prevent the movement of any business as against the Gulf lines.

Subsequent to the issue of the tariffs named above from Missouri river to the Gulf the Chicago Board of Trade took the matter up very vigorously and agitated the question so persistently and effectively that a conference was finally held between the eastern lines and western lines and after a full discussion of the situation the eastern lines concluded to delegate the rate-making authority to the lines terminating on the Missouri river in establishing the rates from the Missouri river to Atlantic seaboard points. A fair and equitable percentage division was agreed to as between the eastern and western lines, thereby enabling the western lines to meet the competition of the Gulf lines and make the rates precisely as they would if the rails were actually owned and controlled by them from the Missouri river to Atlantic ports.

The meeting at which this arrangement was made was held in Chicago on January 21st. On January 30th a number of Chicago lines established rate on corn from Omaha to Baltimore of 17c. per 100 lbs., with the usual differentials to New York and Philadelphia.

February 3, the Chicago & North Western established through rates from Nebraska points to Baltimore and other Atlantic ports based on the locals to Omaha plus 17c. per 100 lbs. Omaha to Baltimore, using the Fremont rate of 23½c. per 100 lbs. arrived at in this manner, as the maximum from intermediate points in the State of Iowa. On the same date the Chicago, Burlington & Quincy established a rate from Missouri river to Baltimore of 13c. per 100 lbs., with the usual differentials to New York and Philadelphia.

February 4, the Chicago, Rock Island & Pacific established proportional rates to Chicago from Iowa points using 12c. per 100 lbs. as the maximum from points intermediate to Missouri river and making reductions of from 1 to 4c.

February 5, the Missouri Pacific established a proportional rate of 11c. per 100 lbs. from Omaha to Westwego and 5c. per 100 lbs. to St. Louis. On the same date the C., B. & Q. established a proportional rate of 5c. per 100 lbs. to St. Louis and 8c. per 100 lbs. to Chicago from Omaha and Kansas City. February 6, the other Gulf lines followed the Mo. Pac. Ry. in establishing a proportional rate of 11c. per 100 lbs. from Omaha and 10c. per 100 lbs. from Kansas City to Gulf ports.

On the same date the Illinois Central published a rate of 13c. per 100 lbs. from Omaha to Baltimore with the usual differentials to New York and Philadelphia.

Taking effect February 7, two of the Chicago lines established a rate of 11½c. per 100 lbs. from Omaha and Kansas City to Baltimore with the usual differentials to New York and Philadelphia, these rates being in effect at the present time by all lines. The rates to Gulf ports at the present time are, as stated above, from Omaha 11c. and from Kansas City 10c.

The Missouri river-upper Mississippi river-Chicago lines have had several conferences with the Gulf lines regarding reductions made subsequent to December 29, and were assured at such meeting that the rates were made for specific quantities of grain and would expire in a short time; therefore, action was deferred. It developed, however, at the second meeting held, that at the moment that a representative of one of the Gulf lines was protesting against any action being taken and assuring the upper, Mississippi river-Chicago lines that their rates would soon expire, and that it would not be productive of any beneficial result to meet their action, a telegram was received from Washington showing that this same line had filed tariffs providing for new engagements for increasing the tonnage via the Gulf ports.

Covering 1,491,419 bushels Jan. 10, 1905.
" 102,856 " Jan. 16, 1905.

The provocation for the original reduced tariff has been the subject of controversy between the Illinois Central and the Missouri Pacific, it being stated by the latter that a prominent elevator grain firm was paying prices throughout the territory west of the Missouri river that could not by any possible method of handling the business yield to the Illinois Central and its connections the full tariff rate then in force, and the explanation given was that the elevator company in question received transfer and elevator charges at intermediate as well as Gulf ports which enabled them to pay prices that controlled the grain and, therefore, the Missouri Pacific felt justified in making a tariff that would place them on a parity for securing their share of the business as against the methods they alleged were employed by Illinois Central and its connections.

The following table shows the general trend of these rates during the present disturbance:

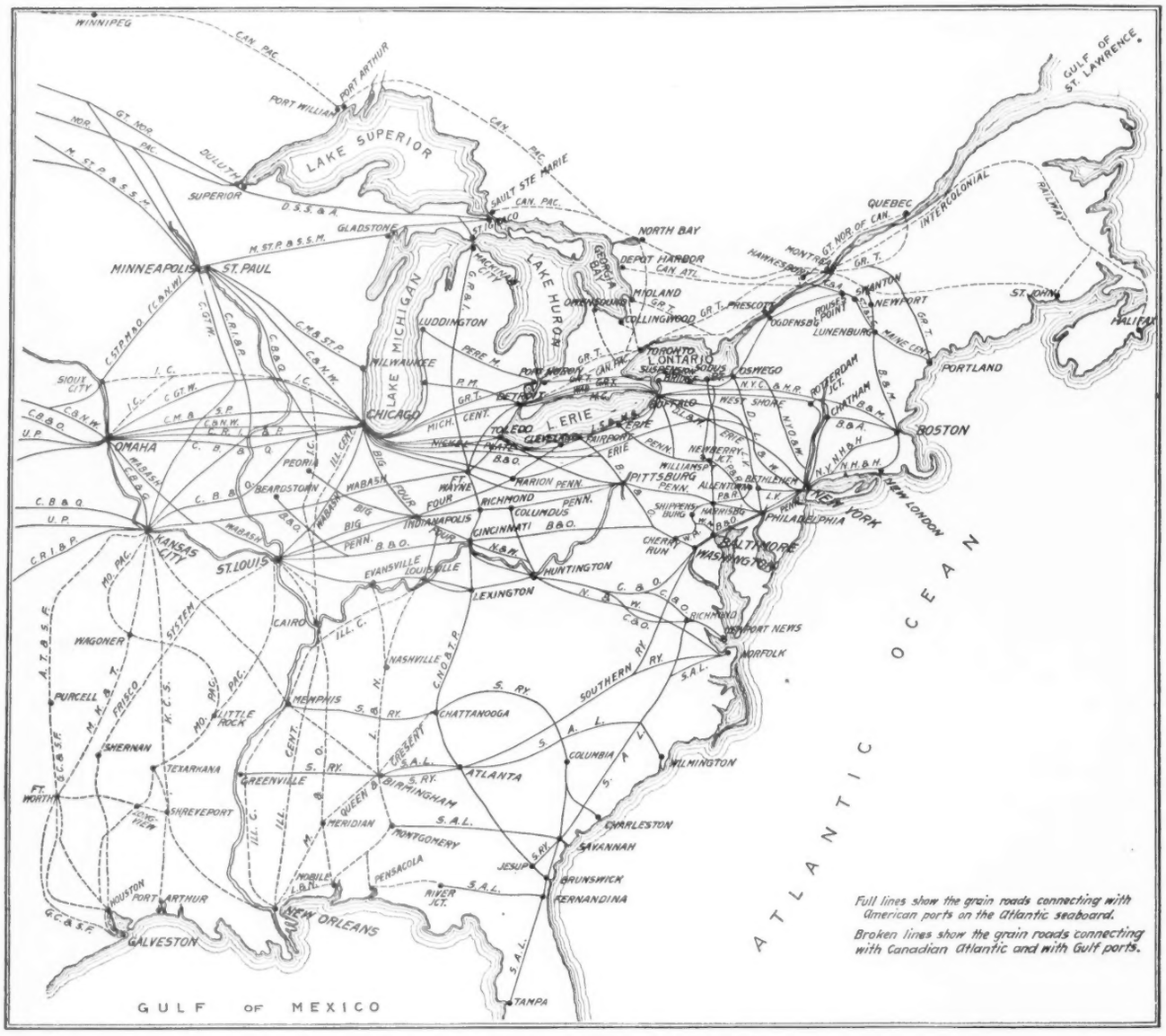
Grain Rate Reductions Since December.

	Rate, cents, per 100 lbs. Prior to Dec. 29.	Dec. 29.	Feb. 4.
Omaha to the Gulf	18	13.5	11
Kansas City to the Gulf	17	13.5	10
Omaha & K. C. to Balt.	24	....	11.5
" " " Phila.	24.5	....	12
" " " N. Y.	25.5	....	13
Chicago to Baltimore	13.5	....	12
" " Philadelphia	14	....	12.5
" " New York	15	....	13.5

The concluding table shows graphically the result of the rate cutting by the Gulf lines.

THE MOVEMENT OF WHEAT AND CORN, WEEK BY WEEK, BETWEEN DECEMBER 3, 1904, AND FEBRUARY 11, 1905.

	Total bushels, wheat and corn, week ending— Dec. 3, '04.	Dec. 10, '04.	Dec. 17, '04.	Dec. 24, '04.	Dec. 31, '04.	Jan. 1, '05.	Jan. 14, '05.	Jan. 21, '05.	Jan. 28, '05.	Feb. 4, '05.	Feb. 11, '05.
New York	57,603	138,572	461,779	542,111	801,713	609,644	915,269	613,817	708,464	763,952	822,942
Boston	4,232	131,964	240,251	194,656	337,269	442,486	330,332	366,078	153,488	377,081	237,204
Philadelphia	231,345	10,715	248,570	94,421	411,426	398,025	17,143	367,424	68,570	258,285	183,428
Baltimore	26,995	361,498	287,143	202,576	617,241	329,570	518,369	466,047	489,108	783,070	375,483
Newport N. & Norfolk	26,191	2,128	170,000	198,457	297,536	191,353	460,463	188,466	396,828	177,470	205,814
Galveston	77,142	120,857	142,860	.....	43,000	78,000	804,284	175,000	687,571	152,000	274,285
New Orleans	4,807	19,431	15,684	498,809	900,373	686,259	692,965	1,114,605	1,483,559	2,421,981	590,439
Montreal & St. John	33,382	42,361	32,299	72,257	30,789	29,498	7,865	121,819	22,670	47,835	41,144
Portland, Me.	.....	96,894	144,450	.....	261,403	120,000	149,307	145,714	158,727	310,765	16,000
Total, Atlantic	379,748	784,132	1,584,492	1,304,478	2,757,377	2,120,576	2,398,748	2,269,365	1,997,855	2,718,458	1,882,015
Total, Gulf	81,949	140,288	158,544	498,809	943,373	764,259	1,497,249	1,289,605	2,171,130	2,573,981	864,724
Per cent. Gulf to total	17	15	8	27	25	27	38	36	51	48	31



Grain Routes to the Atlantic and Gulf Ports.

It will be seen that the proportion of Gulf shipments to the total of the ports recorded rose from a minimum of 8 per cent., Dec. 17, 1904, to a maximum of 51 per cent., the last week in January, while the shipments from New Orleans alone, for the week ending Feb. 4, were greater than from the total of the Atlantic ports in most of the weeks under review.

The following table enumerates in detail the proportion of the haul which is borne by each of the grain carrying roads, as illustrated on the map, above.

Trunk Line Railroad Distances and Connections.

CANADIAN ATLANTIC PORTS.

1. *Canadian Pacific Ry., Duluth to Montreal* 1,042 *Miles.*
   D., S. S. & A. Ry., Duluth to Sault Ste. Marie, 420 miles; Canadian Pacific Ry., Sault Ste. Marie to Montreal, 622 miles ..... 1,042 Miles.
2. *Canadian Pacific Ry., Chicago to Montreal,* 841 *Miles.*
   Wabash R. R., Chicago to Detroit, 272 miles; Canadian Pacific Ry., Detroit to Montreal, 569 miles ..... 841 Miles.
3. *Grand Trunk Ry., Chicago to Montreal,* 840 *Miles.*
   Grand Trunk Western Ry., Chicago to Port Huron, 335 miles; Grand Trunk Ry., Port Huron to Montreal, 505 miles ..... 840 Miles.
4. *Canadian Pacific Ry., Chicago to St. John, N. B.,* 1,322 *Miles.*
   Wabash R. R., Chicago to Detroit, 272 miles; Canadian Pacific Ry., Detroit to St. John, N. B., 1,050 miles... 1,322 Miles.
5. *Canadian Pacific Ry., Chicago to Halifax,* 1,597 *Miles.*
   Wabash R. R., Chicago to Detroit, 272 miles; Canadian Pacific Ry., Detroit to St. John, N. B., 1,050 miles; Inter-Colonial Ry., St. John to Halifax, 275 miles. 1,597 Miles.

UNITED STATES ATLANTIC PORTS.

1. *Grand Trunk Ry., Chicago to Portland,* 1,136 *Miles.*
   Grand Trunk Western Ry., Chicago to Port Huron, 335 miles; Grand Trunk Ry., Port Huron to Portland, 801 miles ..... 1,136 Miles.
2. *Canadian Pacific Ry. Chicago to Portland,* 1,121 *Miles.*
   Wabash R. R., Chicago to Detroit, 272 miles; Can. Pac. Ry., Detroit to Newport, 670 miles; Boston & Maine R. R., Newport to St. Johnsbury, 45 miles; St. Johnsbury & Lake Champlain R. R., St. Johnsbury to Lunenburg, 23 miles; Maine Central R. R., Lunenburg to Portland, 111 miles ..... 1,121 Miles.
3. *Canadian Pacific Ry., Chicago to Boston,* 1,193 *Miles.*
   Wabash R. R., Chicago to Detroit, 272 miles; Can. Pac. Ry., Detroit to Newport, 670 miles; Boston & Maine R. R., Newport to Boston, 251 miles ..... 1,193 Miles.
4. *Canadian Pacific Ry., Duluth to Boston,* 1,400 *Miles...*
   D. S. S. & A. R. R., Duluth to St. Ste. Marie, 420 miles; Can. Pac. Ry., St. Ste. Marie to Newport, 729 miles; Boston & Maine R. R., Newport to Boston, 251 miles ..... 1,400 Miles.
5. *Grand Trunk Ry., Chicago to Boston,* 1,018 *Miles.*
   Grand Trunk Ry., Chicago to Buffalo, 537 miles; West Shore R. R., Buffalo to Rotterdam Jct., 269 miles; Boston & Maine R. R., Rotterdam Jct. to Boston, 212 miles ..... 1,018 Miles.
6. *N. Y. C. & H. R. R. R., Chicago to Boston,* 1,039 *Miles.*
   L., S. & M. R. R., Chicago to Buffalo, 540 miles; N. Y. C. & H. R. R. R., Buffalo to Chatham, 322 miles; Boston & Albany R. R., Chatham to Boston, 177 miles ..... 1,039 Miles.
7. *Pennsylvania R. R., Chicago to Boston,* 1,147 *Miles.*
   P., F. W. & C. R. R., Chicago

to Pittsburgh, 468 miles; P. R. R., Pittsburgh to New York, 445 miles; N. Y., N. H. & H. R. R., New York to Boston, 234 miles. 1,147 Miles.

8. *Lehigh Valley R. R., Chicago to Boston,*
Wabash R. R., Chicago to Buffalo, 525 miles; L. V. R. R., Buffalo to Owego, 195 miles; Erie R. R., Owego to Binghamton, 22 miles; D. & H. Co., Binghamton to Mechanicville, 143 miles; Boston & Maine R. R., Mechanicville to Boston, 189 miles ..... 1,074 Miles.
Wabash R. R., Chicago to Buffalo, 525 miles; L. V. R. R., Buffalo to New York, 448 miles; N. Y., N. H. & H. R. R., New York to Boston, 234 miles..... 1,207 Miles.

9. *N. Y. C. & H. R. R. R., Chicago to New York,*
L. S. & M. S. R. R., Chicago to Buffalo, 540 miles; N. Y. C. & H. R. R. R., Buffalo to New York, 440 miles ..... 980 Miles.
Mich. Cent. R. R., Chicago to Buffalo, 535 miles; N. Y. C. & H. R. R. R., Buffalo to New York, 440 miles ..... 975 Miles.

10. *West Shore R. R., Chicago to New York,*
Mich. Cent. R. R., Chicago to Buffalo, 535 miles; West Shore R. R., Buffalo to New York, 428 miles..... 963 Miles.
Grand Trunk Ry., Chicago to Buffalo, 537 miles; West Shore R. R., Buffalo to New York, 428 miles..... 965 Miles.

11. *Lehigh Valley R. R., Chicago to New York, 985 Miles.*
Grand Trunk Ry., Chicago to Buffalo, 537 miles; L. V. R. R., Buffalo to New York, 448 miles..... 985 Miles.

12. *D., L. & W. R. R., Chicago to New York, 932 Miles.*
Nickel Plate R. R., Chicago to Buffalo, 523 miles; D., L. & W. R. R., Buffalo to New York, 409 miles..... 932 Miles.

13. *N. Y. O. & W. R. R., Chicago to New York, 975 Miles.*
Wabash R. R., Chicago to Sus. Bridge, 500 miles; N. Y. C. & H. R. R. R., Sus. Bridge to Oswego, 151 miles; N. Y., O. & W. R. R., Oswego to New York, 324 miles ..... 975 Miles.

14. *Erie R. R., Chicago to New York, 986 Miles.*
C. & E. R. R., Chicago to Marion, 269 miles; Erie R. R., Marion to New York, 717 miles ..... 986 Miles.

15. *N. Y. C. & St. L. R. R. (Nickel Plate), Chicago to New York, 951 Miles.*
N. Y. C. & St. L. R. R., Chicago to Buffalo, 523 miles; West Shore R. R., Buffalo to New York, 428 miles... 951 Miles.

16. *Pennsylvania R. R., Chicago to New York, 913 Miles.*
P., F. W. & C. R. R., Chicago to Pittsburgh, 468 miles; Pennsylvania R. R., Pittsburgh to New York, 445 miles ..... 913 Miles.

17. *Baltimore & Ohio R. R., Chicago to New York, 1,047 Miles.*
B. & O. R. R., Chicago to Philadelphia, 956 miles; Phila. & Read. Ry., Philadelphia to Bound Brook, 59 miles; C. R. R. of N. J., Bound Brook to Cranford Junction, 14 miles; B. & O. R. R., Cranford Junction to New York (Staten Island), 18 miles..... 1,047 Miles.

18. *Baltimore & Ohio R. R., Chicago to Philadelphia* ..... 956 Miles.

19. *Pennsylvania R. R., Chicago to Philadelphia, 822 Miles.*
P., F. W. & C. R. R., Chicago to Pittsburgh, 468 miles; Penna. R. R., Pittsburgh to Philadelphia, 354 miles ..... 822 Miles.

20. *Phila. & Read. Ry. and Lehigh Val. R. R., Chicago to Phila., 953 Miles.*
Grand Trunk Ry., Chicago to Buffalo, 537 miles; Lehigh Valley R. R., Buffalo to Bethlehem, 359 miles; Philadelphia & Reading Ry., Bethlehem to Philadelphia, 57 miles ..... 953 Miles.

21. *Phila. & Read. Ry. & N. Y. C. & H. R. R. R., Chicago to Phila., 1,025 Miles.*
Mich. Cent. R. R., Chicago to Buffalo, 535 miles; N. Y. C. & H. R. R. R., Buffalo to Lyons, 104 miles; Fall Brook Route, Lyons to Newberry Junction, 183 miles; Phila. & Read. Ry., Newberry Junction to Philadelphia, 203 miles... ... 1,025 Miles.

22. *Baltimore & Ohio R. R., Chicago to Baltimore* ..... 860 Miles.

23. *Pennsylvania R. R. Chicago to Baltimore, 802 Miles.*
P., F. W. & C. R. R., Chicago to Pittsburgh, 468 miles; Pennsylvania R. R., Pittsburgh to Baltimore, 334 miles ..... 802 Miles.

24. *Chesapeake & Ohio R. R., Chicago to Newport News, 961 Miles.*
C., C., C. & St. L. R. R. (Big Four), Chicago to Cincinnati, 305 miles; C. & O. R. R., Cincinnati to Newport News, 656 miles. 961 Miles.

25. *Norfolk & Western R. R., Chicago to Norfolk 1,021 Miles.*
C. & E. R. R., Chicago to Marion, 269 miles; Hocking Valley Ry., Marion to Columbus, 45 miles; Norfolk & Western R. R., Columbus to Norfolk, 707 miles.... 1,021 Miles.

GULF PORTS.

From Chicago:

1. *Illinois Central R. R., Chicago to New Orleans* ..... 914 Miles.

2. *Louisville & Nashville R. R., Chicago to New Orleans, 1,068 Miles.*
C. & E. I. R. R., Chicago to Terre Haute, 178 miles; E. & T. H. R. R., Terre Haute to Evansville, 109 miles; L. & N. R. R., Evansville to New Orleans, 781 miles ..... 1,068 Miles.

From Kansas City:

3. *Kansas City Southern Ry. (Port Arthur Route). Kansas City to Port Arthur*..... 786 Miles.

4. *Santa Fe System, Kansas City to Galveston, 916 Miles.*
A., T. & S. F. R. R., Kansas City to Purcell, 398 miles; G. C. & S. F. R. R., Purcell to Galveston, 518 miles 916 Miles.

5. *Missouri, Kansas & Texas, Kansas City to Galveston*..... 884 Miles

6. *Missouri Pacific Ry., Kansas City to Galveston, 890 Miles.*
Mo. Pac. Ry., Kansas City to Wagoner, 278 miles; M., K. & T., Wagoner to Fort Worth, 268 miles; I. & G. N., Fort Worth to Galveston, 344 miles ..... 890 Miles.

7. *Frisco System, Kansas City to Galveston, 873 Miles.*
St. L. & S. F. R. R., Kansas City to Sherman, 488 miles; H. & T. C. R. R., Sherman to Galveston, 385 miles... 873 Miles.

8. *Missouri Pacific Ry., Kansas City to New Orleans, 1,067 Miles.*
Mo. Pac. Ry., Kansas City to Texarkana, 666 miles; T. & P. R. R., Texarkana to New Orleans, 401 miles... 1,067 Miles.

9. *Frisco System Kansas City to New Orleans, 879 Miles.*
St. L. & S. F. R. R., Kansas City to Memphis, 484 miles; Illinois Central R. R., Memphis to New Orleans, 395 miles ..... 879 Miles.

From St. Louis:

10. *Mobile & Ohio R. R., St. Louis to New Orleans, 705 Miles.*
Mobile & Ohio R. R., St. Louis to Meridian, 509 miles; N. O. & N. E. R. R., Meridian to New Orleans, 196 miles ..... 705 Miles.

11. *Illinois Central R. R., St. Louis to New Orleans* ..... 711 Miles.

12. *Louisville & Nashville R. R., St. Louis to New Orleans*..... 945 Miles.

13. *Missouri Pacific Ry., St. Louis to New Orleans 891 Miles.*
Mo. Pac. Ry., St. Louis to Texarkana, 490 miles; T. & P. R. R., Texarkana to New Orleans, 401 miles.. 891 Miles.

14. *Missouri, Kansas & Texas R. R., St. Louis to Galveston*..... 1,155 Miles.

15. *Missouri Pacific R. R., St. Louis to Galveston, 860 Miles.*
Mo. Pac. Ry., St. Louis to Texarkana, 490 miles; T. & P. R. R., Texarkana to Longview, 90 miles; I. & G. N. R. R., Longview to Galveston, 280 miles ..... 860 Miles.

16. *Frisco System, St. Louis to Galveston 1,031 Miles.*
St. L. & S. F. R. R., St. Louis to Sherman, 646 miles; H. & T. C. R. R., Sherman to Galveston, 385 miles ..... 1,031 Miles.

17. *Mobile & Ohio R. R., St. Louis to Mobile* ..... 644 Miles.

18. *Louisville & Nashville R. R., St. Louis to Mobile* ..... 805 Miles.

19. *Louisville & Nashville R. R., St. Louis to Pensacola* ..... 787 Miles.

Advertising Conditions and Requirements in the Orient.

BY J. S. TANNER.

In a previous issue a short sketch was given of the duties of a passenger agent in the Orient. The present paper considers the advertising conditions that he is called upon to meet. The requirements are somewhat different from those in this country, though the mediums employed are similar, consisting of, first, distribution of descriptive literature and time-tables; second, newspaper advertising, and third, the displaying of pictures and wall maps in public places. As in all advertising, the point to be first considered is the class of traveling public it is desired to reach. In the Orient this may be briefly divided into two classes. The first, and probably the largest class, comprise tourists who are on a globe-circling tour desirous of seeing all the most interesting and world renowned sights on their route, and to whom expense is of secondary importance; these are very probably visiting the American Continent for the first time, and routes and conditions of travel are entirely new to them. The second, but by no means less important class, consists of residents in the Far East returning home on a vacation or making a business trip, and, those tourists from America who are returning home via the Pacific. The majority of these are fully acquainted with the various overland routes, but what they seek is accurate and up-to-date information regarding train schedules and connections, in order that they may fully plan their trip before starting and so advise business connections or friends of the expected dates of their arrival. The number of Europeans desiring information in regard to settling in this country is so small that they need not be considered in this article, though the well posted passenger agent will of course be fully capable of giving the desired information. Asiatic emi-

gration is also an entirely separate matter foreign to the subject of this article.

Up to about two years ago, the European hotels, that is those hotels catering to European travel whether run by natives of the and the usual wall maps. The principal country or by foreigners, were a perfect paradise for the advertising agent. The walls of the reading rooms, rotundas, and halls were covered with advertisements of all kinds. An annual charge was made to curio dealers, Chinese tailors, and traders in general, but free wall space was granted to the different transportation companies. These advertisements were all neatly framed and those of the curio dealers were veritable works of art; good prices were obtained for choice situations, netting quite an addition to the hotel's income. The railroad and steamship companies doing business to American and European ports were represented by photos or lithographs of their steamers, views along their respective roads transpacific lines also had folder cases and frames for special sailing notices occupying the most prominent positions in the main vestibule. These cases were either of handsomely carved native woods or Japanese lacquered, and were most attractive. Unfortunately modern requirements have necessitated redecoration or remodeling of interiors, or rebuilding of premises, and with more expensive decorations this happy state of affairs is disappearing. Pictures and maps have been relegated to side halls and bar rooms, folder cases to obscure corners, with a possibility that even these may go before long, with permission perhaps to retain one general case as in this country.

Throughout the interior of Japan it has been customary for some of the larger companies to hang up posters and wall maps in the many teahouses and native hotels along the routes frequented by tourists; beyond keeping the name of a company in evidence, however, there is not much value attached to this form of advertising, as owing to the extreme moisture of the climate they soon become worn out and look unattractive unless frequently renewed.

Newspaper advertising is a large item, cash being invariably paid for all space. The larger companies will contract for double columns of from 6 to 8 in. in the principal dailies, with smaller space in the less prominent ones and the weeklies. Judging from the number of newspapers published in the English language throughout the Orient, journalism must be a profitable enterprise.

With the yearly tendency to increase rates and considering the value of this form of advertising, a considerable reduction could be made without decreasing its usefulness. The advertisements consist chiefly of the respective sailing schedules of each company, with the usual eulogies of the line that have long been eliminated from similar advertisements in this country. The insertion of sailing lists for some three to four months ahead is all that is required, the circulation practically being confined to the residents and business men; the latter find the publications of these schedules a convenient form for reference. In addition to this regular advertisement the companies also insert for one week, prior to each sailing, a notice of that particular steamer with the date and proposed hour of sailing, and immediately on the steamer's arrival in port an "express" or hand bill is circulated throughout the business district, definitely advising the hour of departure; this is looked upon as final, barring accidents. Dependent as the Far East is on shipping for mails and freights, the importance attaching to these shipping advertisements can readily be seen. The very greatest care must be exercised in seeing that they are correct and up to date. Native type setters being employed makes this doubly necessary; frequent changes in schedules should be avoided as much as possible; and when the sailing hour has once been published, it should be strictly adhered to. Punctuality should be the watchword; some companies would seem to hardly realize the importance of this. Regarding descriptive folders, time-tables, etc., it should be unnecessary to state the importance of having these up to date. A glance at some of the folder cases throughout the Orient, however, would show that this is not always given the attention it deserves. This may be due to new supplies not being received from headquarters or to lack of supervision. The majority of tourists perhaps may not be affected, but to the business man whose every moment is planned out previous to his departure, or to those who are making close connection with some Atlantic steamer, inaccurate time-tables may prove a serious matter. Agencies in the Orient should be promptly supplied with all new issues by the first outgoing steamer, and notices of important changes in train services and connections sent forward as long before the date effective as possible; whenever necessary the cable should be used, in order that agents may be in a position to give passengers up-to-date information. Supplies, as a general rule, should be forwarded monthly and in sufficient quantities only for a month's consumption; an excessive stock on hand is liable to damage by the dampness of the climate. Care should be exercised in packing, each supply of the different publications should be wrapped in heavy paper and these again packed in strong cases of medium size. Lack of attention in this respect will cause expensive and unnecessary loss. It should be borne in mind by every one handling advertising matter that though distributed free to the public it is only issued at great expense to their company.

A concise and comprehensive guide, published under one cover, is needed for distribution in the Orient. This should embrace a brief but complete account of the entire route from the Pacific to the Atlantic with details of side trips to well-known sights off the main route, also a description and plans of the transpacific steamers. The booklet should be attractively gotten up, with illustrations from photographs and include approximate rates of passage and time occupied as a basis for estimating expenses and length of tour. A separate handbook covering passenger tariffs, sailing schedules, and conditions of travel should be issued in cheaper form, thus obviating the necessity of frequent revision of the more expensive guide. A similar guide, to include around the world tours, would also be of value for distribution in England, and throughout Europe this would not replace the many different guide books published in Far Eastern countries but would form a sort of index to the sights to be seen. The transcontinental line would benefit by the fact that passengers would be familiarizing themselves with the American portion of their tour during spare moments on the outward voyage. The many publications now issued are excellent in their way, but passengers will not carry around with them a handful or more of loose folders, but prefer to await their arrival on this side. By that time their route is already decided upon.

The main function of all advertising is to sufficiently interest the traveling public so that they will take the first opportunity of calling at the office for more detailed information. This being accomplished, and with capable passenger agents, half the battle is won.

Owing to the increasing difficulty of obtaining suitable wall space and also that it is often impossible to replace broken glass of large size, pictures should not exceed 24 x 20 in., outside measurement. They should be preferably photographs on bromide paper neatly framed and bearing only the company's name in small lettering; the better the picture, the better the position that can be obtained for it. As a protection from damp all pictures should be backed with oil cloth, the edges turned over to include the glass. Wall maps should be glazed and mounted on heavy mill board and should not exceed 30 x 18 to 20 in.; the usual standard size as a general rule is too large, and is easily affected by the climate.

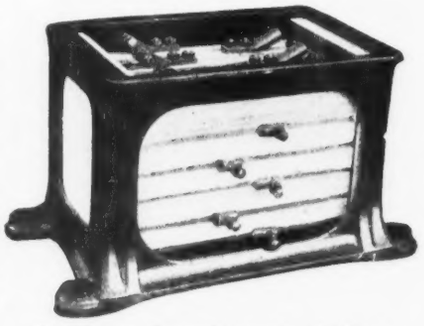
The local passenger travel between way ports in China and Japan is a source of advertisement that should by no means be neglected by transpacific lines. Personal experience of a certain steamer and acquaintances formed with her officers on some local voyage is often a determining factor when arranging a future trip across the Pacific. This traffic, therefore, should not be lost sight of when deciding the hours of arrival and departure at intermediate ports. The personnel of the officers is another important point affecting the popularity of a line; officers on transpacific liners associate more with the passengers, when off duty, than is customary on the shorter Atlantic voyages. In conclusion, the day for cheap advertising has gone by; large sums are now spent annually in issuing attractive and artistic advertising matter, and the greatest care therefore is required to see that there is no undue loss of material and that the fullest benefit is obtained from its distribution.

Maps and pictures should be kept in good repair and replaced when necessary; folders and time-tables kept up to date. Neglected advertising matter is worse than useless.

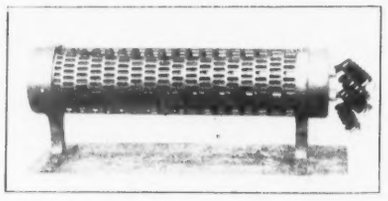
The Chamonix Electric Railway.

BY EMILE GUARINI.

The Payet-Chamonix Martigni Electric Railway, called for brevity the Chamonix electric railway, which is now nearing completion, follows the valley of the Arve, and



Resistance Box—Chamonix Railway.

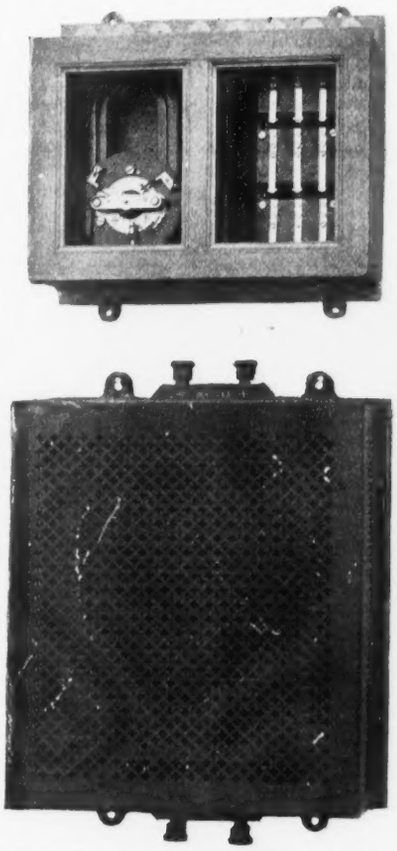


Electric Heater—Chamonix Railway.

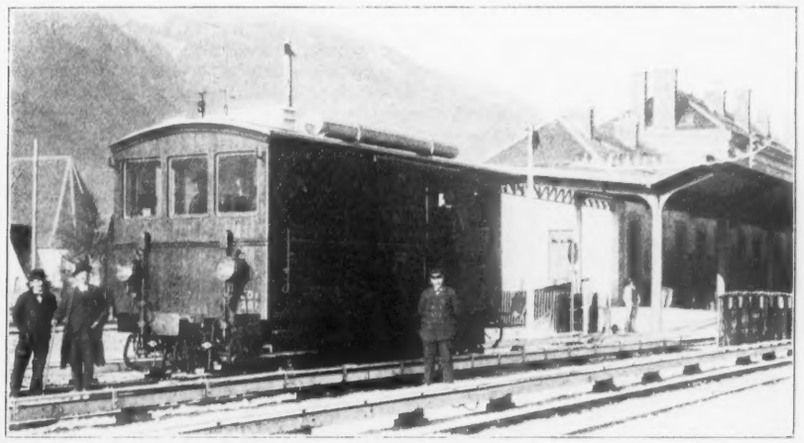
crossings of this river have necessitated the erection of seven large bridges, five of which are metal of 82 to 147.5 ft. span, and one is built of masonry 82 ft. long. The road is

22.3 miles long, of which 11.8 miles are in operation, or will be in the near future. The roadbed is laid with rails 13.9 ft. long, weighing about 69 lbs. per yard. The gage is one meter. The current conductor is a third rail, and the pressure is from 500 to 550 volts. The third rail is protected in front of all the stations and for a length of about 33 ft. on each side of grade crossings by a wooden covering. The third rail is insulated by wooden blocks treated with paraffine and mounted on the ends of two consecutive ties.

Direct current for the operation of the road is generated in two hydraulic power houses, water from the River Arve being utilized. The equipment of both stations comprises four continuous current generators of 200 k.w. capacity, each coupled by means of elastic clutches to horizontal shaft turbines, and two exciter sets of 40 k.w. capacity, each driven by turbines of the same type. Three generators and one exciter are in reserve.



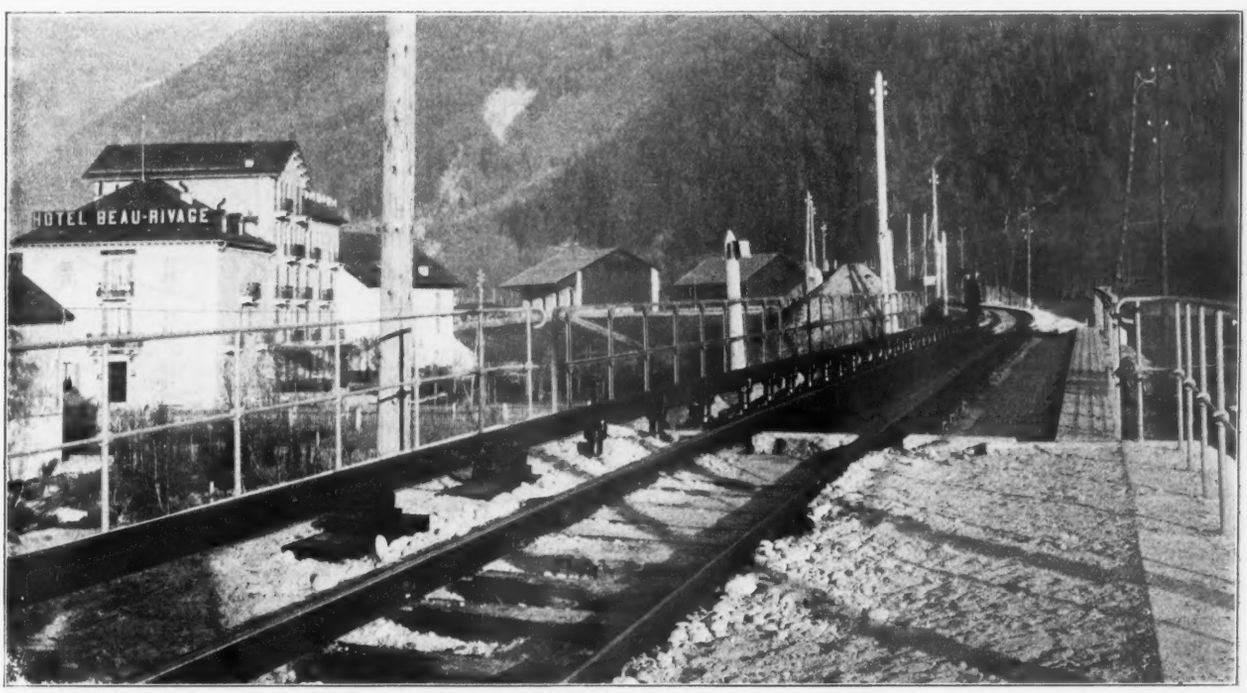
Voltage Regulator for Lighting Circuit—Chamonix Railway.



View of Station Showing Protected Third Rail—Chamonix Railway.

The rolling stock comprises 80 motor cars and a number of trailers, and was built by the Société Nouvelle des Établissements de l'Horme et de la Buyre, of Lyons, the electrical equipment being installed by the Société d'Électricité Alioth of Münchenstine. The arrangement of the motors (one on each axle of the truck) offered great difficulties. The motors are placed at right angles to the axles and transmit the motion through a beveled pinion, which is geared to the axles through an elastic pinion which contains in its lower part a lubricant for the purpose of avoiding the wear on the teeth. The motors are of the four pole type with two consequent poles, and the pole pieces of the frame are mild steel. They form a tight case of two parts bolted together horizontally. The two motors being always coupled in parallel, it is only necessary to reverse the direction of the current in the armature to obtain a very quick stop, even on heavy grades.

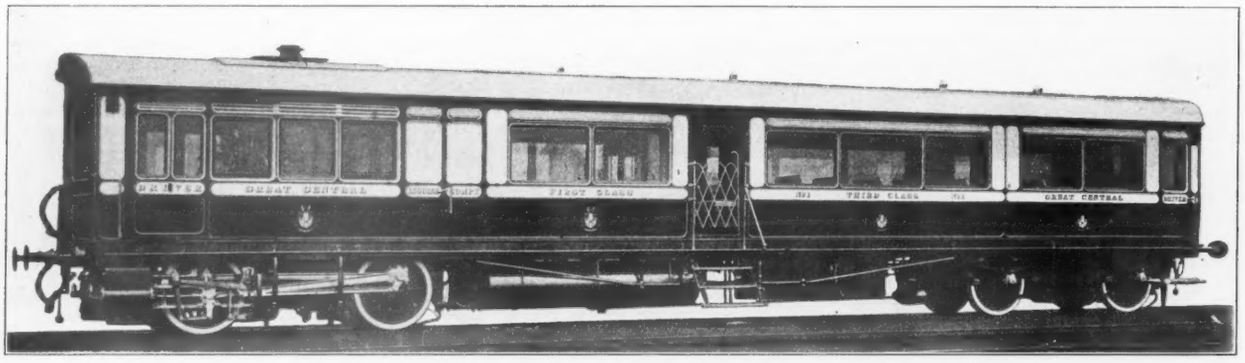
All the cars of a train are controlled simultaneously by the motorman of the forward car by means of compressed air motors. The controller is very simple, comprising but five forward and five reverse positions, only permitting coupling the motors in parallel. The four speeds in both directions are obtained by interpolating suitable resistance in the motor circuit, and the fifth speed is obtained by shunting the field. The lighting of each motor car consists of two parallel groups of five lamps in series, the signal lights being oil lamps. The heating is by means of electric radiators which are operated by a switch giving three degrees of heat.



Arrangement of Third Rail—Chamonix Railway.

Steam Motor Cars on the Great Central of England.

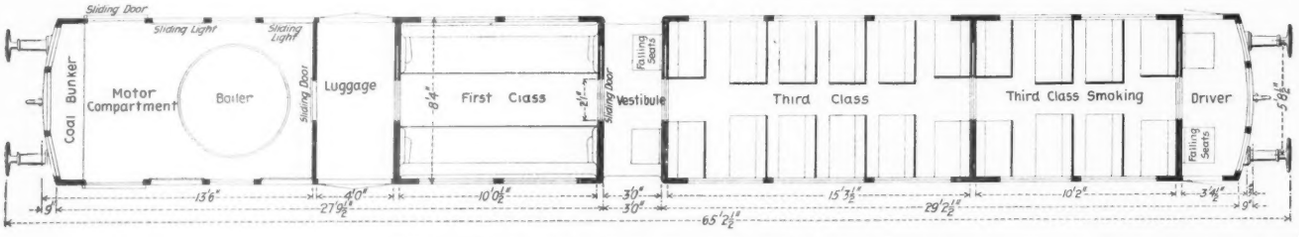
A few months ago, the Great Central of England, following the practice recently adopted by other British railroads, decided to experiment with a number of steam driven motor cars in local services. Two cars were, a short time ago, put in hand at the company's locomotive shops, at Gorton, near Manchester, and one of these cars has just been completed and is now being put to work on the Liverpool and North Wales section of the Great Central. By the courtesy of Mr. J. G. Robinson, the Chief Mechanical Engineer of the Great Central road—from whose designs the cars are being built—we are enabled to show a plan and photograph of the first of these motor cars. Each of these cars is 61 ft. 6 in. long over the body and is divided into the following compartments: Motor compartment; luggage compartment; first class compartment; vestibule; third class compartment; third class (smoking) compartment; and operator's compartment. The car seats 12 first class and 44 third class passengers. The first class compartment has longitudinal spring seats and backs, upholstered in green cloth, and finished in walnut and sycamore, the roof being of Lincrusta-Walton, picked out in gold. The third class compartments are finished in teak wood, with match boarding and pitch pine panels, and are furnished with transverse seats. The smoking and non-smoking compartments are divided by sliding doors. The third class seats and backs, which are covered in rattan, are reversible. Ventilation is provided over each window and in the roofs, and all of the passenger compartments are heated by steam from the engine.



Steam Motor Car—Great Central, England.

Entrance to the car is by the center vestibule or gangway, which leads both into the first and third class compartments. This gangway is fitted with collapsible gates and is provided with steps to enable the passengers to enter from the road level. These steps are hinged, so that, when not in use, they swing back to the width of the ordinary footboard, but when used they are forced outwards, being actuated by means of levers in the gangway. The car underframe is steel, carried at one end on a bogie truck, the wheels of which are cushioned. The outer end of the car is supported on the engine truck and is arranged so that the vibration from the engine is not transmitted to the car. Vacuum automatic brakes with an auxiliary hand-brake are used. The car is lighted throughout by electricity, including the leading and trailing lights, which can be switched on and off according to the direction in which the car may be traveling. The steam regulator, whistles, vacuum and hand-brakes are controlled by the operator from either end, and the conductor may communicate with him by means of electric bells. The coal is stored in the motor compartment and the water in large tanks suspended from the bottom of the frame, along with the accumulators and dynamo for supplying the light. The dynamo is driven by a belt running round a pulley fixed on one of the axles. The engine is fitted with a vertical boiler of the multitubular type, made of steel plates with a copper fire-box. The boiler contains 450 tubes, 1¼ in. in diameter.

The cost of operating these motor cars ranges from 9 to 14 cents per "train" mile, and according to Sir Alexander Henderson Bart. M. P., the Chairman of the Directorate of the Great Central, if the working of the first two experimental cars comes up to expectations, the principle will be rapidly extended to other portions of the road in order to secure fast, frequent, and economical train services on country lines or to supplement the existing steam train services in the neighborhood of busy towns.



Plan of Steam Motor Car—Great Central, England.

The Development of Electric Traction.*

To Thomas Davenport, blacksmith, of Brandon, Vermont, belongs the honor of making the first recorded experiment in electric traction, for in 1834 he showed at Springfield and again in Boston a toy model, mounted on wheels, and propelled a few feet on a circular railway from a primary battery. Four years later Robert Davidson, of Aberdeen, constructed a locomotive which was tried on the Edinburgh-Glasgow railway. In 1847 Moses G. Farmer, one of the most prolific of early experimenters, exhibited a small model at Dover, N. H., and three years later in Boston Thomas Hall showed an automatically reversing motor. A year later Professor Page, of the Smithsonian Institute, with Congressional help, equipped and ran a car on a road near Washington. All these and various other experiments of those early years depended on the use of primary battery, and hence, irrespective of the shortcomings of the machines themselves, commercial success was impossible. It was not until the invention by Pacinotti in 1861 of the continuous current dynamo, improved and developed by Siemens, Whitestone, Varley, Rowland and others, and the discovery of the reversible functions of the dynamo electric machine said to have been made originally by Pacinotti in 1867, but certainly proved, some say at first by accident, by Gramme and Fontaine in 1873, that the key to the transmission of energy was found.

Between this date and the beginning of experimental work on modern lines I find a mention of but one name, that of George Greene, a poor mechanic in Kalamazoo, Mich., who built a model operated from a battery through the track and an overhead wire.

About four years later three inventors whose names are known the world over became almost simultaneously and independently interested in electric railways. They were Dr. Werner Siemens, Stephen D. Field and Thomas A. Edison. To the former belongs the credit of actually operating the first road supplied from a dynamo which carried passengers, as shown at the Berlin Exposition in 1879. A toy-like affair it was, a miniature locomotive pulling three small cars seating about 20 passengers. As illustrating how trivial facts connected with early experiments stand out, one of the younger Siemens recently told me that these small cars being provided with division arms, no little anxiety was displayed when it was discovered that to accommodate the German Emperor, a man of large physique, one of them had to be removed. I note that this practice has been extended to our Subway

*From an address by Frank J. Sprague at a dinner given by the American Institute of Electical Engineers, Feb. 8, 1905.

to provide room for our every-day emperors.

The demonstration by Siemens was followed by other exhibition equipments, and in 1881 by the installation of a short line with one car at Lichterfelde near Berlin, the first commercial road. This was followed by others by the same house, and an ambitious project for an elevated railway in Vienna.

In 1879 Field filed a caveat, showing an electric railway taking current from a wire enclosed in a slot, and in 1881 made experiments in Stockbridge, Mass. In 1880 Edison, utilizing one of his old Z lighting dynamos, constructed and operated a small road in a yard of his laboratory at Menlo Park, using the two rails as conductors.

About this time various other inventors began to take up the study of the subject, and Jenkins, Ayrton and Perry began the development of telpherage or automobile railways. Chance is oftentimes responsible for inventions, and perhaps for my own entry into the railroad field, for although I had become interested as early as 1879 in the possibilities of a somewhat eccentric motor, it was not until 1882, when my duties as a member of a jury at the Crystal Palace, Sydenham, London, took me on the Underground Railway, that I seriously considered this special problem. This interest took the form of a project for operating that road by adopting the general system of constant potential supply developed by Edison for electric lighting, and using the tracks as one conductor, an overhead one supported by the roof as the other, contact with the latter to be made by a roller carried on a spring-supported saddle, a forerunner of the modern trolley.

My ambition in this and other electric affairs cost the Navy a possible Admiral, and my friends much annoyance, for I very shortly afterwards resigned from the service and returned to the States in 1883. In this year Field and Edison combined forces, and exhibited at the Chicago Railway Exhibition a locomotive called the Judge, which ran around the gallery, the motor used being a Weston electric light dynamo. Siemens also installed the first line in Great Britain—that at Portrush, Ireland, and another short line was installed at Brighton by Magnus Volk. Charles J. Van Depoele, a wood-carver by trade, but an electrician at heart and an indefatigable worker, began experiments at his factory in Chicago, using a five-light dynamo on a car platform, and taking current from a wire laid in a slotted plank, following this by a short line at the Industrial Exhibition.

It was in 1883, too, that that veteran of early struggles, Leo Daft, began his labors at Greenville, N. J., following them that fall with the operation of the Ampere at Saratoga, and soon after with small roads elsewhere. Bentley and Knight began their experiments in the yards of the Brush Electric Company, and in the following year they installed a short conduit line in Cleveland, which was spasmodically operated during that winter. In the latter year Van Depoele operated a road at the Toronto Exhibition, and about that period Anthony Reckenzaun, a particularly able engineer, actively conducted storage battery work abroad.

The year 1885 was prolific. Daft began operations in Baltimore on the Hampden branch of the Union Passenger Railway with two locomotives, this being, I think, the first regularly operated railroad in the country. His ambitious work on the Manhattan Elevated with the Benjamin Franklin was a remarkable effort, but like all then made on that road, as well as those made a number of years afterward, met with but little encouragement.

I had now resumed railroad studies, and began the construction of motors for experiments on this road, these being used first on a private track in an old sugar refinery, and then on the elevated in May of the following year, but on somewhat different lines, for the motors were centered on the axles of regular trucks, geared to them and freely supported at one end, this practice being subsequently generally adopted, but after some months, I too, quit, and then tried the construction of a locomotive car. Meanwhile Van Depoele had begun operations at South Bend and Minneapolis, Henry had installed a small line in Kansas City, and Short had embarked on experiments with a series system at Denver. This and the next two years saw active work by all of us who had ventured in this new field, some with central station and others with storage battery supply, the principal roads actually installed being by Van Depoele and Daft.

Reviewing the conditions at the beginning of 1887, statistics compiled by Mr. Martin, including every kind of equipment, summed up but nine installations in Europe and ten in the United States, with an aggregate of less than 60 miles of track and about 100 motors and motor cars. These were characterized by the utmost diversity of practice. There were high and low pressures; third rail and side; slotted overhead tubes; single and double overhead wires; single and double carriages on them; and upward-pressing arms carried on the cars. The motors were of varied construction and control, generally carried on a locomotive or the front platform of the car, and connected to one wheel by a friction or chain drive. The cars were usually single-ended and controlled from one point. The art was in a chaotic state, and a commercial opportunity on a large scale, as well as some departures in practice were necessary to bring home to railroad men the possibilities of electric traction, even then thrusting themselves into prominence. That opportunity, the equipment of the Richmond Union Passenger Railway, fell by good fortune to my company, and that year may be fairly said to mark the beginning of active development.

Richmond's story is an old one and typical, but it offered greater possibilities because of its greater extent. It was a new confederacy to be assaulted, a confederacy of physical difficulties, adverse conditions, and all the ills of a new and untried system. But Richmond fell again, and the mule was freed. How? But that is a long story, it has been often told, and I will not detain you save with but two or three incidents of which the presence of certain guests here to-night remind me.

The first occurred when one night, after running the gauntlet of a crowd filled with the enthusiasm of liquid politics and being nearly ditched in a curve, we arrived at the foot of a 10 per cent. grade, foreshortened in the dark into a precipice. As we stopped at the bottom I turned to George Burt, the manager, and said, "We can't make it," for I knew the conditions of the machines. You are all familiar with the air of authoritative assertion that comes natural to the old railroad official. It is said that we sometimes get it in the naval and military service, and it was with this air that Burt said to me, "If you can get out of that curve you can climb the side of a house." Well we did, but when at the top it was with a pair of red-hot machines partly disabled, and resting on our laurels, we put out our lights, dismissed the crowd, and Dana Green went for the instruments, four stalwart mules, who in undoubted gratitude extended effectual aid; but if I remember rightly it was their last similar service.

And once a sleet storm, adding to the burden of our trouble, had tied up the road completely. With the coming of dawn Capitol Hill was a crystal forest kissed by the rising sun, and overhead the slender copper wire on which hung our hopes was sheathed in ice. A wireless message went from heart to heart, "How goes Richmond?" and the answer was, "Not a wheel turning." Testing the lines, I found, as the ice began to melt, that the current had been turned on, and I started to slowly work a construction car toward our car barn. In olden days victorious admirals and successful pirates carried a broom at the royal mast head in token of supremacy, and in recent years our beloved poet, Oliver Wendell Holmes, has immortalized the broomstick train; but I doubt if ever that homely instrument was put to more effective and unique use than on that winter morn, for as I came to the top of a heavy grade, I saw a broom in the hands of a strong-armed Irishman, one of my most reliable and best beloved men, Pat O'Shaughnessey, who, stationed on the top of a car slowly mounting the hill, was swatting the trolley line with all his might, while with every blow a convulsive shiver ran along its spine, and a hundred feet of the enemy lay shattered before the wheels of his juggernaut.

And then, again, the fate of the cable hung in the balance in the streets of Boston. Henry Whitney and his able lieutenants had gone to Allegheny, where Bentley and Knight, after great exertion, had succeeded in installing a short conduit and trolley line, and then they came to Richmond, to see what promise there was in electricity. A car barn was a luxury, and it was our habit to store 22 cars on the open line at one end, and on a section which ordinarily should have but two or three cars in operation at one time. Mr. Whitney's manager had demanded to know what would happen in case of a block, and the necessity of starting a large number of cars. I determined to make the attempt, and so about midnight I aroused Mr. Whitney from his bed, and told him what I proposed to do. Returning to the power-house, I instructed the engineer to load up the safety catches, raise the potential, and hang on no matter what happened. The men were instructed to start their cars as quickly as possible at the swing of a lantern, but being closely packed together, it was, as in every practical case, impossible to simultaneously start, but they pulled out one after another at short intervals, until shortly the whole group was in motion. That test settled the fate of the cable.

No sooner was the track adopted on an essential of the electric railway, than there began the battle with the telephone companies, who claimed the earth and all that therein was, which was fought, first to a draw, then to a legal and technical finish. We remained below, they for their own good went up higher.

The adoption of electricity on the West End road by Mr. Whitney, to whom must be awarded the credit for initiating the modern consolidations of street railways, was followed by a period of extraordinary activity in commercial and technical development, in which for a time the Sprague and Thomson-Houston Companies were the principal competitors. This development has no parallel, and to the query how came it so, I answer: It was due to the genius of opportunity, the crying needs of transportation, and the quick wit which saw the coming light.

The ten years following Richmond were marked by continued and vital improvements in apparatus and equipments, among which must be specially mentioned the introduction of the carbon brush by Van Depoele, the Thomson magnetic blow-out by Potter, form wound armatures by Eickmeyer, and the combination of resistance and series

parallel control, the latter originally proposed by Hopkinson in 1880. Cast-iron gave way to steel, two-pole motors to four, self-open motors to closed and self-protected and the single gear again resumed sway.

For a long time the single trolley held, and for much of the future will continue to hold, first place because of simplicity, effectiveness and minimum first cost. The Allegheny and Boston conduits had been abandoned, but in 1893 a short line was tried in Washington on the Love system, and in the following year work was begun in New York on the Lenox avenue line and carried to that successful conclusion which warranted its adoption there under the auspices of William Whitney and Henry Vreeland, and soon after in Washington under Connett, although a line had been in operation at Budapest for some time.

Train operation as distinguished from that of single cars began on the South London road in 1890, and this was followed by various proposals for the New York Elevated, the installation of the Intramural road at the World's Fair, Chicago, the equipment of the Lake Street Elevated, and by other installations. Heavy locomotives were built in 1892 and 1893, both for experimental work and for regular operation in the Baltimore & Ohio tunnel.

Meanwhile the limitations of direct-current motor work were greatly extended by the developments in polyphase transmission, and the transformation into continuous current at lower pressure by static and rotary transformers, through the work of Tesla, Stanley, Scott and others. The first actual proposal to use this combination was made in 1896 by our past president, Mr. Arnold, and it has now become the standard practice.

One immediate result was that rapid introduction of comparatively long distance high speed interurban lines, which although generally operating single cars have had such an influence upon steam railroads, and been so instrumental in welding together urban and rural communities. But with all the advances made, train operation was still limited, and largely because of adherence to old-established locomotive practice. Having been for a long time engaged in developing the indirect control of elevators, the thought suddenly flashed upon me that trains could be better operated by simultaneously operating a number of controllers, each with its own motors, thus allowing any desired aggregation of independent units in a train having all the characteristics of the individual. This, known as the "multiple unit" system, received its baptism on a train of cars at Schenectady in 1897, and was first adopted on the South Side Elevated of Chicago, although I had for a long time begged for an opportunity to make a demonstration on the Manhattan Elevated, as I had begged for many years for electric operation in all rapid transit work. It was, of course, a logical development, and has now received the stamp of universal recognition. Some measure of its practical importance may be gathered from the statement that by reason of the increase in capacity alone, it has the potentiality of adding at least 15 million of dollars to the capitalized value of the Subway.

Up to the present time almost all important work has been conducted with continuous current motors at moderate potentials, but on any large system this requires the transmission of energy primarily from a long distance by alternating current, and reduction to a lower pressure and transformation at substations.

To economically extend the radius of electric operation from these sub-stations, it is, of course, essential to work at comparatively high pressure, and in order to attain this end without running into serious or assumed difficulties with continuous current motors, as well as to get rid of the moving element in sub-stations, the activities of leading engineers, among whom must be mentioned Tesla, Finzi, Lamme, Eichberg and Steinmetz, have for some time been bent on the development of the alternating current motor. The earlier attempts in this direction were for a machine without a commutator, that is, one that could be operated by polyphase currents, and it is on these lines that the admirable work of the Ganz Company, and the high speed tests on the Zossen military line in Germany have been carried. But the recent developments, in this country at least, have been almost wholly along lines of single-phase operation in order to maintain the simplicity of the present trolley line practice. A large measure of success has already been attained in this direction, so much so that the single-phase motor can now be accepted as an essential contribution to railway operation, its adoption being a matter of individual determination. In this connection I should add that Mr. Arnold was one of the earliest and has been one of the most consistent advocates of single-phase operation.

Such is a brief and imperfect review of an industrial development whose spidery web has enmeshed our modern life, and is rapidly changing the current of our affairs.

Our esteemed Senator, Mr. Depew, has been quoted recently as saying that in ten years the only place for a steam locomotive would be a museum. Is the wish father to the thought, or does it mean the awakening of our railroad officials to the possibilities of the future? If so, then we indeed have reason to congratulate ourselves, for there is much work ahead. But let us be in no hurry to build museums, for in spite of any development which may take place, our old friend, the steam locomotive, will be on deck and doing business at the end of another decade, although his younger brother will be giving him an interesting tussle. We have indeed 30 thousand miles of line to the credit of the electric railway in this country alone, but the character of the traffic and the service performed by these lines is absolutely distinct from that pertaining to trunk line operation. It is sustained, not extraordinary maximum speed which is required in practical service, and sustained speed is a matter of finance.

What, then, will determine the future? Solely this financial factor, as it must the future of any other great industrial problem. When savings in operation and the increased returns from traffic on any road will more than pay a fair dividend on money invested for electrical equipment, then and then only will trunk lines, great or small, be operated electrically. As I have often stated, the problem resolves itself into a question of relative density and the character of load factor, and these essentials are, of course, vitally connected with the allowed working potential on a trolley line. There is a tendency to assume that the limitation of operations by continuous current motors has been reached, and that the only possible large development is with alternating current motors. I say God speed the alternating current motor, and every mile it adds to the radius of action is a mile to the good, but speed also its sister, which has as yet by no means reached the limit of its usefulness.

Rails for Lines With Fast Trains.*

BY P. H. DUDLEY.

(*Continued from page 118.*)

Chapter 9 takes up the chemical and physical characteristics of the metal in rails and locomotive wheel tires. Twenty-six companies replying favored a chemical composition for rails about as shown in the accompanying table, which may be termed a high carbon steel. Five companies only favored a low carbon steel of .40 to .50 carbon content for heavy sections, and three steel makers who replied favored the specifications adopted some time ago by their association which may be classed as low carbon. The severe service to which rails are now subjected requires considerable hardness to resist wear, and the best rails are a compromise between metal best suited to resist the stresses induced as girders and metal with hardness to resist wear.

High carbon rails have decidedly better wearing qualities than low carbon rails in the heavier sections. In 1895 the inbound main track in the yard of the Grand Central Station was laid with 100-lb. high carbon rails, and in nine years these rails have carried over 250 million tons with a reduction in height of only $^1/_{16}$ in. Frogs made from these rails last from two and one-half to three years as compared to six or eight months for low carbon rails in frogs in the same location. Frogs made from high carbon rails have been in service in important crossings in the Grand Central yard for five years before renewal.

	Weight of rails—			
	75-lb.	80-lb.	90-lb.	100-lb.
Carbon	0.45 to 0.55	0.50 to 0.60	0.53 to 0.63	0.55 to 0.65
Silicon	.15 " .20	.15 " .20	.15 " .20	.15 " .20
Manganese	1.00 " 1.20	1.00 " 1.20	1.10 " 1.30	1.10 " 1.30
Sulphur not to exceed	0.08	0.08	0.08	0.08
Phosphorus not to exceed	.09	.09	.09	.09

The physical properties of steel for rails have not received consideration from many railroad companies because of the fact that up to within a few years ago nothing was known of the stresses to which the rails were subjected in the track. Tests with the author's stremmatograph show that the bending moments in 80-lb. rails under present wheel loads may be as high as 300,000 to 350,000 in. lbs., indicating a unit fiber stress of as much as 40,000 lbs. This lasts for a small fraction of a second only and is followed by a smaller stress of an opposite character, but nevertheless the metal should have a high enough elastic limit so that the fiber stress will not be so great as to impart a permanent set to the rail. With the stiffer 6-in., 100-lb. section and the same unit fiber stresses the bending moments can run up as high as 500,000 in. lbs. without the metal taking a set. The general opinion seems to be that what is required is a metal which will resist wear without being brittle and that the necessary strength as a girder can be obtained by modifying the section to meet the needs of the traffic carried.

Briefly summed up, the wear and deformation of rails results from the following causes:

1. Surface wear of the heads, due to rolling loads.
2. Surface wear of the heads, due to adhesion of the locomotive drivers.
3. Surface wear of the heads, due to the retarding effect of the brakes.
4. Surface wear of the heads, due to sanding the rails.
5. Oxidation of the surface of the rails.

*Abstract of a report to be presented to the International Railway Congress to be held in Washington, D. C., May, 1905.

6. Wear of the base of the rails on the crossties and under the spikes.

7. Wear and oxidation of the metal of the heads and bases of the rails at the fishing angles with the splice bars.

8. Wear and deformation of the metal of the facing ends of the rails at the joints.

9. Wear of the surface of the rail due to gradients.

10. Wear and abrasion of the heads of the rails due to curvature.

11. Wear and distortion of the surface of the rail heads by hollow wheel treads.

12. Large positive and negative bending moments and consequent unit fiber stresses to carry and distribute the wheel loads, reversing with each passing wheel.

13. Large shearing stresses in the web of the rails connecting the positive and negative bending moments.

14. Thermal stresses due to changes of temperature, before the rail ends move in the splice bars.

15. Shearing stresses in the webs through the holes, due to the rails riding the bolts.

16. Excessive bending moments and shocks due to eccentric or flat wheels of the equipment.

17. Unexpected stresses in rails under service, from the difficulty of maintaining uniformly all parts in proper adjustment.

The relation between the tires of a locomotive and the rails is an important one and intelligent co-operation of the motive power department will do much to assist the maintenance of way department in keeping the track up to safe standards for carrying fast trains. The proper chemical composition of tire steel is an open question. Some roads specify 0.60 to 0.75 carbon and 0.20 to 0.30 silicon, and on others the specifications call for lower content of both of these. The Pennsylvania's specification is as follows:

	Service	
	Passenger.	Freight.
Carbon	0.55 to 0.70	0.55 to 0.70
Silicon	.10 " .20	.10 " .20
Manganese	.60 " .75	.60 " .75
Sulphur not to exceed.	0.06	0.06
Phosphorus not excdg.	.05	.05

The Pennsylvania is also trying some nickel steel tires, but no information as to the results is obtainable. One road which runs through a sandy country reports that it considers steel of harder than the usual grade a necessity in that sandy country and buys all of its tires of extra hard steel, equal to Krupp's in density.

While more care is taken with the ingots for tires than for rails, there is abundant evidence that greater attention is necessary to secure solidity of the steel. First in the ingot, secondly in the various steps during subsequent manufacture. This has been ascertained recently by the rapid deformation and failure of tires for trailing wheels, under the Atlantic type of engines, designed to carry a static load of from 36,000 to 38,000 lbs. per axle. Several of the tires flattened in places on the tread, the steel underneath the surface being crushed, and pieces became detached. This was traced to a slight porosity or unsoundness in the steel. Nearly all of the ingots from which the tires were made were 12-sided, and in some of the angles there was evidence that unsound metal developed in the cooling. These tires contained 0.62 to 0.67 per cent. of carbon, manganese 0.65 to 0.78, silicon 0.20 to 0.26, phosphorus 0.06. They were hard on the surface from manufacture, and photo-micrographs showed that beneath the skin the structure was much coarser and more fragile than upon the outside. Several of the trailing wheels from heats differing by months in manufacture, failed when first put into service. In the imperfect tires, the steel was flattened irregularly at several points, but not for the entire circumference in the tread, as at some of the corners more unsoundness was developed than at others. Slight etchings of these tires did not show decided defects, but continued for some time, lack of uniform solid metal was disclosed. The trailing tires were 50 in. in diameter, compared to 79 in. on the driving wheels, for the same locomotive, consequently when made from the same steel and ingot, they did not receive proportionately the same amount of work in their manufacture. As soon as the tires commence to flatten, the riding under the trailing wheel becomes rough, pounds, checks or breaks rails in extreme cold weather, and is a source of greater danger to the engineer of maintenance of way, than to the superintendent of motive power. In the circumference of these tires, five and six flattened spots have been found, but only in one or two instances have they occurred for the entire circumference.

The manufacturer usually determines the tensile strength and elastic limits of his steel for tires, from small test ingots from each heat, and not from the product in the tires of different diameters. The tensile strength may not show a wide range of va-

Surface of Defective Trailing Truck Wheel Tire.

riations, but the elastic limits which are the index to the suitability of the metal for the purposes intended, will vary thousands of pounds, and the consumer does not secure the grade of metal he requires for the service.

Since heavy axle loads have become the rule, the wear of the driving wheel tires has been much more rapid, decreasing the mileage for a given loss of metal. Steel of finer structure would undoubtedly reduce this wear and increase the life of the tire. The pitting of the treads is caused by the steel being principally "coarse granular" or "cellular." The ferrite surrounding the pearlite becomes detached and small portions of the cells drop out of the tread of the wheel. Under the present locomotives, having static loads of 48,000 to 50,000 lbs. per axle, examination of the coarse structure of the tires shows that the pearlite of the cells enclosed by the ferrite breaks down unevenly upon the surface of the tread of the wheel. This has been confirmed by taking portions of the tires, polishing the bearing surface, and adapting them to a testing machine, over a rail resting on crossties, and applying pressures corresponding to the axle loads. The surface was injured and instead of presenting a smooth compression due to mass hardness of metal, showed an irregular broken surface due to cell hardness. In ordinary tires the author has been unable to find any which show an interlocked structure such as has been produced in rails. The cross sections of tires are massive compared to those of rails, and from the greater number of heat units contained, the coarse structure is more readily developed. "A fine structure" has a higher modulus of cubic elasticity or volume, and would conduce also to a slower and smoother wear of the wheel treads.

Heat treatment can be applied in several ways to refine the coarse structure of the tires. Nickel will produce a steel of finer structure than ordinary steel, without treatment.

Fig. 1 shows a section of tire from trailing wheels, having a designed static load of 38,000 lbs. per axle. The dynamic load was greater than this, however. The metal from ⅛ in. to ¼ in. underneath the surface of the tread, owing to porosity in the ingot, crushed and fractured, and shearing occurred, making a flat place in the tread. The metal was not homogeneous and failed to sustain and maintain the section and configuration of the circumference of the tire.

On steel tired tender wheels of locomotives, it has been noticed sometimes that the rear tires of the truck have a series of flats, about 1 in. to ½ in. long for the entire circumference of the tread. Each flat spot is separated by a transverse band about ½ in. wide which retains nearly the normal diameter. Similar flat spots for the entire tread have not been observed upon any other wheels of a locomotive, though found in rear truck wheels of sleepers and coaches which run long distances in one direction.

On the Boston Elevated, the tires for the electric motors wear polygonal, and require grinding once or twice a month. The spots at first are short, then two or more unite until there are only 16 to 20 for the entire circumference of the wheel. Between each flattened or worn spot, there is left a portion of the metal which hardens by the action of the brake-shoe and does not reduce as fast as the other parts of the tread of the wheel. Examining these bands under the miscroscope shows that there are a series of transverse cracks in them, indicating a tensile strain on the surface of the metal exceeding the elastic limits. The treads of the wheels between the high portions are scored by a series of irregular diagonal lines across the tread. The rail heads on the sharp curves were abraded by forcing the wheel treads diagonally across the top of the rail.

Ordinary steel rails of about 0.45 to 0.50 carbon content on curves of 90 to 110 ft. radius, were reduced in height one-half of an inch, in 90 to 120 days. Rails of higher carbon have since been introduced, which wear four to five times as long.

Report of the Illinois Railroad and Warehouse Commission.

The thirty-fourth annual report of the Illinois Railroad and Warehouse Commission was transmitted to the Governor on February 16. Illinois is reported still to lead all states in mileage of steam railroads, and for the first time in many years not a single mile of such road within its borders is in the hands of a receiver. Records of casualties for the year show 25 passengers killed and 462 injured, or one killed for every 2,125,927, and one injured for every 115,039 carried. In commenting on the need of adequately safeguarding crossings of every kind, figures on the growth of electric roads are given. In 1903 the total mileage for this

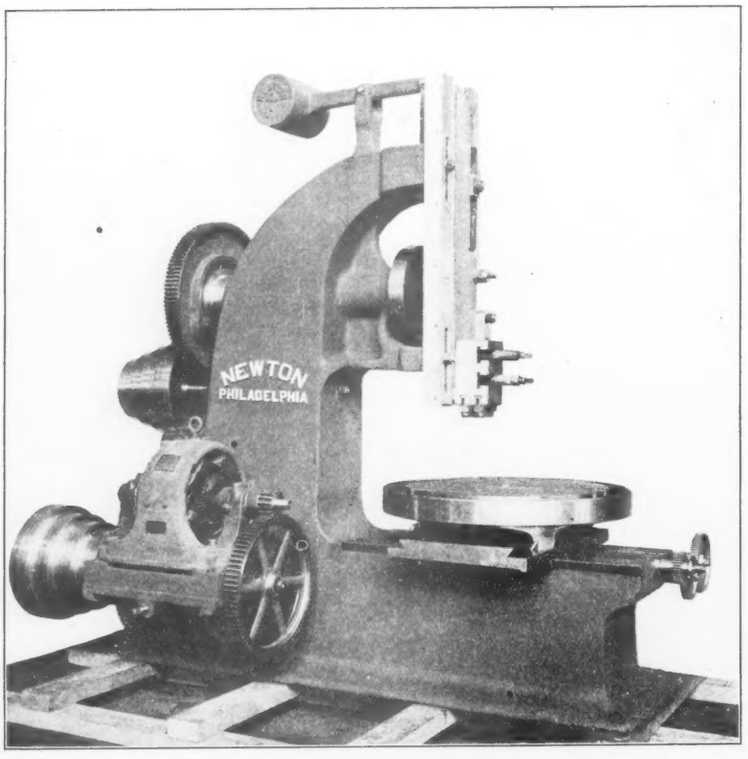


Fig. 1.—The Newton Slotter.

class of road was 365 miles of main line and branches. In 1904 this had increased to 586 miles, a gain for the year of 221 miles. A large number of miles are under construction and a number of new companies have been incorporated. The steam roads now have 11,529 miles, an increase of 300 miles for the year. Other trackage brings the grand total up to 19,021 miles, a gain for the year of 510 miles.

The total earnings and income from operation of steam railroads for the year ending June 30, 1904, was $139,749,392, an increase over the previous year of $6,936,858. The total income from passenger service, including mails and express for the year, was $34,280,529, the total from freight service was $88,722,088, and from unclassified earnings was $10,089,548. The total number of passengers carried contributing to revenue was 53,143,198. The average distance carried was 26.7 miles. The average amount received from each passenger was $0.51, and the amount per mile of line earned by passenger service was $2,923, an increase of passenger earnings per mile over the previous year of $194.

The number of tons of revenue freight carried was 122,002,531. The average distance haul of one ton in miles was 101.7 miles, the average amount received for each ton of freight was $0.76, and the freight earnings per mile of road were $7,386. The gross earnings from operation per mile were $10,986, the operating expense per mile was $7,608, and the net earnings per mile of road were $3,378. There was an increase of 2,581,375 tons of freight hauled. The average distance haul of one ton is 2.7 miles and the average amount received for each ton of freight was increased $0.01. The freight earnings per mile of road increased $194. The gross earnings from operation per mile of road increased $444. The operating expenses per mile increased $631, and the net earnings per mile of road decreased $187. The number of persons, including officers, employed on steam railroads in the state was 105,790, an increase of 2,405 over the year 1903. There was paid to these officers and employees a total of $70,810,600, or $7,135,973 more than the previous year. During the year 17.59 miles of steam road were laid with iron rails and 11,529 miles (main line and branches) with steel rails, involving the use of 114,565 tons. The number of new ties laid was 5,290,847. There was an increase in the number of stations of 452, the total number now being 3,386.

Fuel consumption shows some interesting figures. In passenger service the total amount of fuel used for the 32,994,380 miles was 1,613,454 tons, or 97.8 lbs. per mile. In freight service 4,123,137 tons were used for 43,641,017 miles, an average of 188.97 lbs. per mile. The total consumption for all services was 7,358,641 tons for 111,167,031 miles, an average of 133.59 lbs. per mile.

Railroad Shop Tools.

(*Continued.*)

SLOTTING MACHINES.

The latest design of 14-in. slotting machine made by the Newton Machine Tool Works is shown in Fig. 1. The machine as shown is direct motor driven, the motor being mounted on an adjustable shelf or saddle and geared to a countershaft, which belts to the driving cone of the machine; the adjustable saddle being used to keep the belt to the required tension. The machine has a maximum stroke of 14½ in. and the work table measures 30 in. in diameter over the tee slots and 36 in. over all. It has a positive variable automatic feed motion in all directions ,operating at top of stroke and giving an in-and-out adjustment to the work table of 28 in., and a cross adjustment of 16 in. The distance from face of ram to frame is 29½ in. and the frame will admit work up to 19¾ in. in height. The ram is counterweighted and has a Whitworth quick return motion, being adjustable for any position and length of stroke up to the maximum length of the stroke. The ram is fitted with an adjustable guide, which can be lowered to re-enforce the cutter bar. A number of machines of this design have been placed in railroad shops throughout the United States, and they are made in sizes ranging from 6 in. to 50 in. stroke.

Fig. 2 shows the 21-in. slotting machine made by the Betts Machine Company, Wilmington, Del. This machine has a maximum stroke of 21¾ in. with adjustment for any position or length of movement. The cutter bar is counterbalanced and has eight speeds. It is provided with a vertically adjusted guide and relief tool apron. The maximum distance from the frame to the front side of the cutting bar is 42 in. The distance from the table to the under side of the

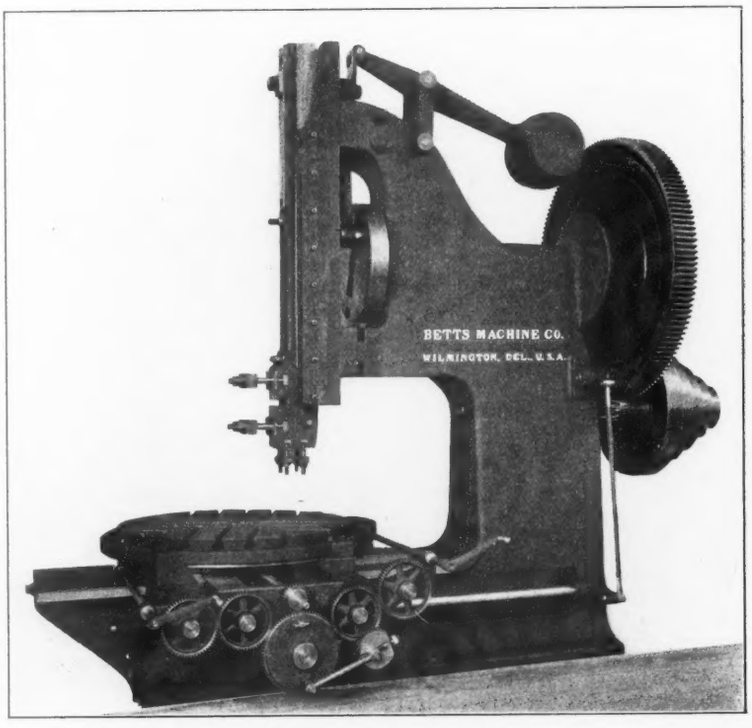


Fig. 2.—The Betts Slotter.

frame is 30 in. The feeds are positive and self-acting in all directions, and the handles for operating the feeds are all placed within easy reach of the operator. The compound tables have a 48-in. adjustment longitudinally and a 44-in. adjustment transversely. A revolving table 48-in. in diameter is mounted on the transverse table. This table is graduated and the worm feed mechanism is arranged so that it can be disengaged while adjusting the work. The weight of the machine is about 30,000 lbs. These machines are also furnished motor driven, in which case the motor is mounted on a bucket, which is secured to the back of the column.

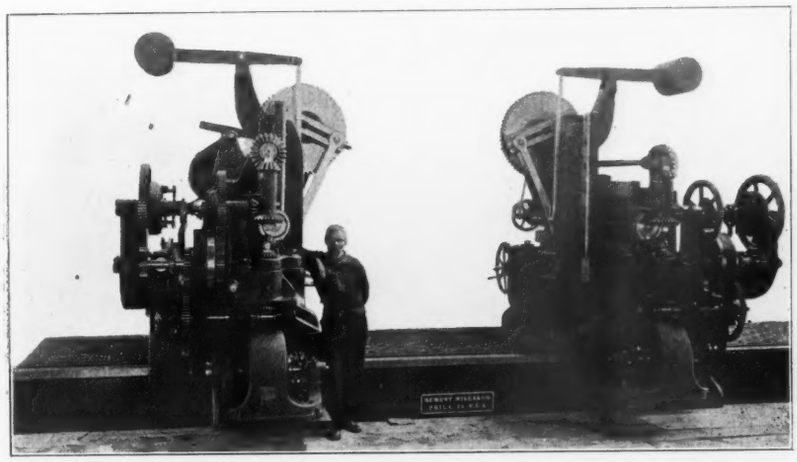


Fig. 3.—The Niles-Bement-Pond Double Head Frame Slotter—Motor Driven.

A double head locomotive frame slotter made by the Bement, Miles Works of the Niles-Bement-Pond Company, New York, is shown in Fig. 3. The opening in the heads of the machine is 49 in. wide by 24½ in. high. The cutter bars are counterbalanced and are provided with quick return motion. They are adjustable for any position or length of stroke up to 24 in. The saddles have variable power feeds on the cross-rails, as well as rapid traverse and hand adjustment. The heads have independent variable power feeds and rapid power movements along the bed. The bed is made in any desired length and each head is driven by a constant speed motor mounted on a bracket which is bolted to the frame of the head. The speed changes are obtained by gearing. These machines can also be operated by one motor placed at the end of the machine, and the power is then transmitted to the heads by means of a splint shaft.

(*To be continued.*)

Train Accidents in the United States in January.[1]

bc, 1st, Cincinnati, Hamilton & Dayton, Middletown, Ohio, butting collision between southbound passenger train No. 3 and a northbound freight train, wrecking both engines and several freight cars. One engineman was killed and three other trainmen were injured.

†bc, 2d, Grand Trunk, Buffalo, N. Y., collision (on the International bridge) between a train consisting of an engine and one passenger car and a freight train. Three passengers were injured, one of them fatally.

xc, 2d, Chicago, Rock Island & El Paso, Logan, N. Mex., a westbound express train collided with a switching engine, badly damaging both engines and one mail car. Four trainmen were injured.

dn, 2d, Chicago Terminal Transfer, a passenger train of the Chicago Great Western was derailed at a derailing switch approaching the crossing of the Wisconsin Central, and the baggage car and one passenger car were overturned. The engineman and two passengers were injured.

unf, 2d, Baltimore & Ohio, West Craddock, W. Va., a passenger train was derailed by a landslide and the engine and first two cars fell down a bank into the river. The engineman was fatally injured.

rc, 3d, Northern Central, Mount Wolf, Pa., a work train consisting of a caboose, three platform cars and a locomotive, the caboose at the head of the train and the engine at the rear, ran into the rear of a freight train standing on the main track; and two cabooses, three platform cars and two box cars were badly damaged. Fifteen employees were injured.

*unx, 3d, Missouri, Kansas & Texas, Rocheport, Mo., passenger train No. 5 was derailed and the first two cars were piled up against the engine in a cut. The baggage car took fire and was burnt up, and two passenger cars were ditched. Four passengers and one employee were injured, the employee fatally.

rc, 4th, Lake Shore & Michigan Southern, Angola, N. Y., the Twentieth Century limited express eastbound, running at reduced speed in consequence of a hot bearing on the engine, was run into at the rear by the Boston and New York express, and eight passengers were injured. There was a blinding snowstorm at the time.

dn, 4th, Lehigh Valley, Weatherly, Pa., a freight train consisting of an engine and 28 loaded cars became uncontrollable on a steep grade and was derailed at a curve, making a bad wreck. The engineman, fireman and one brakeman were killed, and two other brakemen were injured.

unx, 4th, Missouri, Kansas & Texas, Roanoke, Tex., a car in a switching freight train was derailed and, with several other cars, was wrecked. Two unknown men killed.

xc, 5th, Rugby Junction, Wis., a freight train of the Chicago, Milwaukee & St. Paul backed into a freight of the Wisconsin Central at the crossing of the two roads; one brakeman was injured.

xc, 5th, Jacksonville, Fla., passenger train No. 32 of the Atlantic Coast Line, entering the train shed, collided with a train of empty passenger cars backing out. Two mail clerks and three other persons were injured.

xc, 6th, Philadelphia & Reading, Philadelphia, Pa., collision of freight trains in the yard; one engineman killed, one fireman injured.

dn, 6th, Baltimore & Ohio, Glencoe, Pa., a freight train consisting of an engine and 40 loaded cars became uncontrollable on a steep grade and was derailed at a curve, making a bad wreck. One employee and four tramps were killed.

bc, 7th, Yazoo & Mississippi Valley, Ingleside, Miss., butting collision of freight trains; one fireman killed and one engineman injured.

eq, 7th, 2 a.m., Pennsylvania lines, Wooster, Ohio, several cars in an eastbound freight train were derailed by the breaking of a coupling, and the wreck fouled the westbound track.

Fast mail train No. 25 on this track was derailed by the wreck, and a number of mail clerks and trainmen were injured.

rc, 8th, Buffalo, Rochester & Pittsburg, Riverside Junction, N. Y., a passenger train ran into the rear of a preceding freight and the engine was derailed and overturned. The caboose and six freight cars were wrecked. Three trainmen and one passenger were injured.

bc, 9th, 11 a.m., Pennsylvania road, Shamokin, Pa., butting collision between a passenger train and an empty engine. One engineman and one fireman were killed and 10 passengers and three trainmen were injured. An operator failed to deliver an order to the passenger train. It is said that this operator had been attending his sick wife and was exhausted for want of sleep.

†unx, 9th, Cleveland, Cincinnati, Chicago & St. Louis, Rising, Ill., a car in a passenger train was derailed; one passenger killed and 12 injured.

o, 9th, Boston & Albany, Canaan, N. Y., the locomotive of a freight train was wrecked by the explosion of its boiler and three employees were injured.

unx, 10th, Atlantic Coast Line, Switzerland, S. C., the Florida special express southbound was derailed and the three rear cars (baggage car, dining car and one sleeping car) were ditched. Three passengers and four employees were injured. The forward part of the train was uninjured and the train reached St. Augustine, Fla., on time.

rc, 11th, Pennsylvania road, Christiana, Pa., rear collision of freight trains, wrecking one engine and 14 cars. The engineman was fatally injured.

*†rc, 11th, St. Louis Southwestern, Piggott, Ark., a local freight train standing at the station was run into at the rear by an empty engine, and the caboose was wrecked, set afire and burnt up. Four passengers in the caboose were killed and their bodies burned beyond recognition.

dn, 11th, 2 a.m., Chicago, Rock Island & Pacific, Iowa Falls, Iowa, a northbound freight train was derailed at the derailing switch approach to the crossing of the Illinois Central and the engine, 10 cars and the signal cabin were badly damaged. Three trainmen were slightly injured.

dn, 11th, Chicago & Alton, Wann, Ill., a passenger train was derailed at a derailing switch and the engine and mail car were overturned. The conductor and one mail clerk were injured.

unf, 11th, Mobile, Jackson & Kansas City, Beaumont, Miss., passenger train No. 4 was derailed at a washout and the engine and first three cars were overturned. Mr. Sullivan, General Passenger Agent of the road, riding on the engine, was killed, and three trainmen were injured.

o, 11th, Erie road, Creston, Ohio, the locomotive of a freight train was wrecked by the explosion of its boiler; engineman and fireman killed and one trainman injured.

bc, 12th, Atchison, Topeka & Santa Fe, Maxwell, N. Mex., butting collision between eastbound passenger train No. 4 and a westbound freight, making a bad wreck. Both firemen and one other trainman were killed and both enginemen were fatally injured.

unf, 12th, Norfolk & Western, Webb, Ohio, a freight train was derailed by a landslide and the engine was overturned. The engineman was killed and two other employees were injured.

rc, 14th, 4 a.m., St. Louis & San Francisco,

[1] Accidents in which injuries are few or slight and the money loss is apparently small, will as a rule be omitted from this list. The official accident record published by the Interstate Commerce Commission quarterly is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defect of roadway.
eq	Derailments; defect of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

Moselle, Mo., an eastbound freight train unexpectedly stopped on a descending grade was run into at the rear by a following freight, making a bad wreck. Two trainmen were injured. It is said that the second train ran past a block signal set against it.

rc, 15th, 2 a.m., Lake Shore & Michigan Southern, Buffalo, N. Y., eastbound passenger train No. 10 ran into the rear of a preceding switching freight train, damaging the engine, two freight cars and the mail car. Three mail clerks were injured.

unx, 15th, Chicago & Eastern Illinois, Grape Creek, Ill., the locomotive of a passenger train was derailed and ditched and the engineman and fireman were injured.

unx, 16th, Atchison, Topeka & Santa Fe, Derby, Kan., the tender and all of the cars of passenger train No. 116 were derailed and fell down a bank. The express messenger was killed and three other trainmen and seven passengers were injured. The engine was not derailed.

dr, 20th, Boston & Maine, Durham, N. H., a passenger train was derailed by a broken rail; four passengers were injured seriously, and a number of others slightly.

bc, 22d, Louisville & Nashville, Shawnee, Tenn., butting collision of freight trains, one of which was drawn by two engines; four trainmen killed and six injured, three of them fatally.

o, 22d, Baltimore & Ohio, Mountain Lake Park, Md., the locomotive of a freight train was wrecked by the explosion of its boiler, and three loaded cars were damaged. The fireman and one brakeman were killed and the engineman and conductor were injured.

dn, 23d, Cleveland, Cincinnati, Chicago & St. Louis, Lafayette, Ind., a freight train was derailed at a derailing switch approaching the crossing of the Wabash road, and the engine was overturned and fell down a bank. The engineman was killed and the fireman and one other employee were injured.

unf, 23d, Southern Railway, Marion, N. C., a freight train was derailed by running into a landslide and two cars and the caboose were overturned. A brakeman was killed.

xc, 24th, Illinois Terminal, Alton, Ill., a passenger train collided with the tender of a locomotive on a side track, which fouled the main line, and was derailed; and the passenger car, in which were 26 passengers, was overturned. The fireman jumped off and was killed and three passengers were injured.

†unx, 24th, Aberdeen & Asheboro, Troy, N. C., a passenger train was derailed and the passenger car was overturned and fell down a bank. One passenger was killed and six were injured.

dr, 25th, 1 a.m., Cleveland, Cincinnati, Chicago & St. Louis, Lafayette, Ind., a southbound passenger train was derailed by a broken rail and two sleeping cars fell down a bank. Nine passengers were injured.

*dr, 25th, Illinois Central, Cedar Falls, Iowa, passenger train No. 403 was derailed by a broken rail and the baggage car was overturned. It took fire from the stove by which it was heated, but the flames were soon extinguished.

bc, 26th, 2 a.m., Illinois Central, Wingo, Ky., butting collision of freight trains, one of which had run past an appointed meeting station. Both engines were wrecked and were left standing with their boilers upright. One engineman was killed and two brakemen were injured, probably fatally.

*unf, 26th, Central of New Jersey, Freehold, N. J., a passenger train drawn by two engines was derailed in a snowdrift, and one engineman was killed, and the fireman and five passengers injured. The cars took fire from the stoves by which they were heated and were mostly burnt up. The passenger car was overturned and most of the 30 persons in it were cut by glass or suffered minor injuries.

unx, 26th, North Shore Railroad, Tomales, Cal., the engine of a work train running tender first was derailed at a curve and fell down a bank. The conductor was killed and two other trainmen were injured.

bc, 27th, Nashville, Chattanooga & St. Louis, Tullahoma, Tenn., butting collision between a southbound passenger train and a northbound freight; two enginemen and two other men were killed, and several passengers were injured.

dr, 27th, Norfolk & Western, Chillicothe, Ohio, a freight train broke through a bridge and the tender and four cars were wrecked; a brakeman was killed and the engineman was injured.

o, 27th, 9 p.m., Lehigh Valley, North Tonawanda, N. Y., the locomotive of a freight train was wrecked by the explosion of its boiler; engineman and two brakemen killed and three other trainmen injured, one of them fatally.

xc, 28th, Pittsburg, Cincinnati, Chicago & St. Louis, Sulphur Springs, Ind., collision between switching freight trains; three trainmen injured.

bc, 29th, Atchison, Topeka & Santa Fe, Ardmore, Ind. T., butting collision between southbound passenger train No. 19 and a northbound freight; one fireman killed, seven trainmen and two passengers injured.

*xc, 29th, 2 a.m., St. Louis, Iron Mountain & Southern, Wynne, Ark., a freight train descending a grade broke in two and the rear portion afterward ran into the forward one, wrecking one car. The caboose and an oil tank were set on fire by coals from the caboose stove. Two trainmen were injured.

xc, 29th, Norfolk & Western, Portsmouth, Ohio, passenger train No. 21 collided with a freight train at a switch, and the passenger engine and the baggage car were overturned. Three trainmen were injured, one fatally.

o, 29th, Cleveland, Cincinnati, Chicago & St. Louis, Bloomington, Ill., the locomotive of a freight train was wrecked by the explosion of its boiler; fireman killed, two other trainmen injured.

o, 30th, Chicago, Rock Island & Pacific, Ely, Iowa, the locomotive of a freight train was wrecked by the explosion of its boiler, and several cars of live stock and merchandise were derailed. The engineman, fireman and one brakeman were killed.

xc, 31st, Atchison, Topeka & Santa Fe, Williams, Ariz., collision between passenger train No. 8 and a switching engine, wrecking the switcher and killing its engineman and fireman. The engineman of the passenger train was injured.

Grain Elevators in Russia.

It was perhaps 30 years ago that it was announced that grain elevators of the American plan were to be erected at interior as well as terminal stations of the Russian railroads, to provide storage for the accumulation of grain in the fall months, which often had to be stacked in sacks in the open air, and often suffered great damage from the elements before they could be forwarded. Something was done; but in every year of a good harvest, the complaints have been repeated; and in 1902 there was at one time an accumulation of 51,000 car-loads waiting to be forwarded. Last year at harvest time there were great crops in the east and southwest—just the part of the country furthest from market; and in view of this and of the large amount of rolling stock taken from the European lines for use on the Siberian Railroad to serve the army a conference of railroad authorities made special dispositions to avoid a blockade, with such success that at the end of October 91,000 car-loads, or about 40,000,000 bushels, was awaiting shipment, which is 80 per cent. more than in the worst of previous years. The grain producers are compelled to realize on their grain at the earliest possible day, being generally in debt, with creditors pressing. When the fall rains come the roads are impassable, and grain cannot be brought to the stations until there is sleighing. The result is that nearly everyone tries to get his grain to the railroad as soon as possible after harvest. Once there, the railroad must give a receipt for it, on which money can be borrowed. But the railroads cannot carry away the whole crop within a few weeks; and they have provided entirely insufficient storage room.

New Automatic Block Signals for the Harriman Lines.

The new automatic block signals to be installed on Harriman Lines this year cover 657.65 miles of single track road. The larger part of this work will be on the Southern Pacific, 333 miles being allotted to the Pacific System and 74 miles to the Texas lines. The remainder is divided between the Union Pacific and the Oregon Railroad & Navigation, 150.65 miles to the former and 100 miles to the latter. A diagram showing the standard plan of the Southern Pacific for single track automatic block signaling was shown last year (*Railroad Gazette*, March 25, 1904). Fifty-four miles of the new (automatic) signals will take the place of manual signals from Benecia to Sacramento.

The complete schedule of the work for 1905 is as follows:

Union Pacific.	
Gilmore to Valley	22.68 miles.
Buford to Hermosa	7.10 "
Table Rock to Green River	70.87 "
Castle Rock to Wasatch	10.00 "
Ogden to Echo	40.00 "
Total	150.65 miles.
Oregon Railroad & Navigation.	
East Portland to Bonneville	40.00 miles.
Cayuse to Le Grande	60.00 "
Total	100.00 miles.
Southern Pacific—Pacific System.	
Benecia to Sacramento	54.00 miles.
Port Costa to Tracy	50.00 "
Pajaro to Gilroy	19.00 "
Kern Junction to Treves	11.00 "
Tehachapi to Mojave	20.00 "
Saugus to Tunnel	6.00 "
Burbank to Los Angeles	8.00 "
Ventura Junction	1.00 "
Goshen Junction	1.00 "
Dolgeville to Bassett	9.00 "
Colton to Palm Springs	49.00 "
Sparks to Fernley	30.00 "
Harney to Ryndon	50.00 "
Moore to Valley Pass	25.00 "
Total	333.00 miles.
Southern Pacific—Atlantic System (M., L. & T.)	
Avondale to Boutte	13.00 miles.
Des Allemands to Berwick	49.00 "
Cade to Lafayette	12.00 "
Total	74.00 miles.
Grand total	657.65 miles.

NEW SIGNALS ON 21 ROADS.

The foregoing figures serve to amplify our yearly table (Jan. 27). In connection with this announcement from the Harriman lines, it will be of interest to summarize the proposed new work reported by the 17 other roads which had items of this kind in the table of January 27. These items appear as below:

NEW SIGNALING PROPOSED FOR 1905.

Railroad.	Kind.	Miles Single track.	Miles Double track.
Atch., Top. & Santa Fe.	Automatic	30	..
Atch., Top. & Santa Fe.	Manual	153	..
Balt. & Ohio	Automatic	..	60
Balt. & Ohio	Manual	178	..
Chicago G.-W.	Automatic	..	4
Chicago G.-W.	Manual	150	..
Chicago & N.-W.	Automatic	..	31
C., N. O. & T. P.	Automatic	18	3
Del. & Hudson	Automatic	57	42
Illinois Central	Manual	210	..
Mobile & Ohio	"	7	..
Nash., C. & St. L.	"	42	..
N. Y. C. & H. R.	Automatic	..	10
N. Y. O. & W.	"	..	12
Norfolk & Western	"	2	80
Nor. Pacific	Manual	543	..
Penn. R. R.	Automatic	..	11
Penn. R. R.	Manual	..	125
Penn., W. of Pitts.	Automatic	..	78
Penn., W. of Pitts.	Manual	812	62
Phila. & Readg.	Automatic	..	5
Phila. & Readg.	Manual	41	..
Southern	"	327	..
Total		2,570	523

Besides those here shown there should be added the Chicago, Burlington & Quincy, which plans to extend the manual block system as fast as practicable. The new automatic signals on the Chicago & North Western will replace manual signals, the block sections being made shorter. The Illinois Central signals will be "controlled manual." The total mileage shown in the table (3,093 miles) consists of automatic 443 (107 single track and 336 double); and manual 2,650 (2,463 single track and 187 double).

GENERAL NEWS SECTION

NOTES.

The St. Louis & San Francisco has appointed ticket takers on a number of trains.

The sleet storm of week before last broke down so many telegraph wires in parts of Georgia and other southern states that for several days trains on most of the railroads had to be run entirely by time-table. The newspapers of Atlanta and other cities report passenger trains two hours and more behind time in consequence of having to wait at meeting points for superior trains.

In view of the large number of return excursion tickets likely to be sold to Washington on the occasion of the inauguration of the President next week, an attempt was made to secure the passage by Congress of a bill prohibiting the scalping of excursion tickets in the District of Columbia, but the House Committee on District Affairs, before which the argument was made, refused to take favorable action.

The Commercial and Financial Chronicle estimates the gross earnings of the railroads of the United States in 1904 as $1,773,338,878, an increase of $11,137,487 over 1903. There was a decrease of $20,000,000 at the end of the first six months of the year, so that a large gain was necessitated in the last six months to make up the total increase for the year. The chief gain of $3,227,591 was made by the Union Pacific, and the largest loss of $5,225,100 by the Pennsylvania.

The Railroad Commissioners of Minnesota recommend to the legislature the passage of a number of laws giving additional powers to the commission. One of the propositions is to authorize the investigation of accidents and to require railroads to report all accidents. Another is to empower the commission to order the erection of interlocking signals at any point where the commission may deem such apparatus necessary for the public safety. Others require the consent of the commission before advancing freight rates, and provide a penalty for violation of the law requiring state warehouse receipts for grain.

Gift for Four Railroad Hospitals.

It is reported that Mrs. Ida M. Ryan, of Portsmouth, Va., wife of General Passenger Agent C. B. Ryan, of the Seaboard Air Line, has given $60,000 for the erection and equipment of four hospitals along the line of the Seaboard. The hospitals will be built at Portsmouth, Va.; Hamlet, N. C.; Savannah, Ga., and Tampa, Fla. Mrs. Ryan stipulates that the nurses employed shall be Sisters of Charity of the Catholic Church.

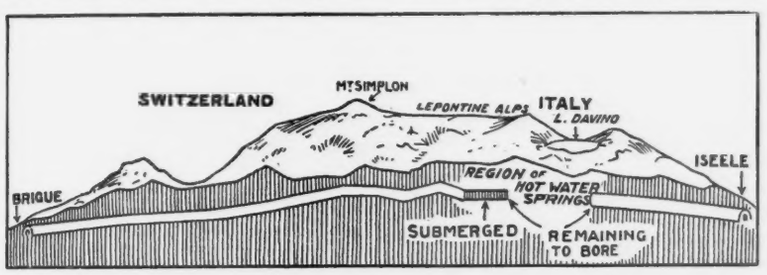
Loving Cup Given to Mr. Moffat.

A silver loving cup on a marble base, the whole 42 in. high, has been presented to Mr. David H. Moffat, owner of the Denver, Northwestern & Pacific Railroad. On one side of the bowl in relief is a bust portrait of Mr. Moffat and the inscription "Moffat Road. The Gateway through the Rockies, Denver, Northwestern & Pacific Railway." On the other side is this inscription: "Presented to David H. Moffat by his business associates of Denver, Colorado, as a tribute to his energy as an empire builder, his loyalty to every interest of his adopted city and state, and above all to that broad citizenship which will remain an inspiration for all the years to come in the upbuilding of Denver and of Colorado." On the cup and on the silver ornamentation of the base are eight views along the line of the Denver, Northwestern & Pacific.

Simplon Tunnel.

The Simplon tunnel, which will be, when finished, 12½ miles long, the longest tunnel in the world, has met with continuous obstacles during the course of construction. Its great length is made necessary by its altitude above sea level (2,310 ft.), which is much lower than that of any other Alpine tunnel; the Arlberg tunnel for example, which is 4,300 ft. above sea level, being 6¼ miles long.

Work on the Simplon tunnel was started in August, 1898, simultaneously from the Swiss and Italian sides. All the 10,000 workmen are Italians, 4,000 having begun work at Brigue, Switzerland, and 6,000 at Iselle on the Italian side. It was believed that the rocks were composed of vertical strata, but they proved to be horizontal on the Italian side. Great streams of water were met, which were turned aside with great difficulty. After this obstacle had been overcome the engineers came upon a bed of moving sand, which threatened to fill the shaft already drilled. Enormous wooden supports were used to stem its rush, but they went to pieces under the great pressure and were replaced by steel stays to hold up the metal plates which kept out the sand. (See the *Railroad Gazette*, Nov. 18, 1904.)



Sectional View of the Simplon Tunnel.

On September 6 springs were met with on the southern side, and since then, up to December 20, 111½ ft. have been tunneled in the first gallery; leaving 689½ ft. to be tunneled. This work will be done entirely from the southern side, boring in the northern side having been abandoned since May, 1904.

The difficulty, according to the chief engineer in charge on the southern side, arises from the fact that at the point of contact with the hot springs the rock is of a cretaceous formation, and on account of its softness the boring is necessarily retarded, since greater precautions are required for the safety of the workmen. A further and even more serious difficulty is the impossibility of men's continuing at work beyond 30 minutes at a time on account of the excessive heat created by the hot springs, which throw out about 16 gallons per second, with a temperature of 46 deg. C. (115 deg. Fahr.) in the first gallery.

The rock through which the tunnel is being driven is mostly granite. By the adoption of the Brandt drill the galleries on the Swiss side were advanced some 20 ft. daily and often more, an unusual amount. The Brandt drill, which is 3 in. in diameter, rotates slowly and is kept at its work by a hydraulic pressure of 1,500 lbs. to the cubic inch or 10 tons on the cutting face of the drill. The waste water is discharged along the axis of the tool, and in this way the tool is kept cool and the rock cut away is washed out. The water discharged from the north and south ends of the tunnel by means of drains cut in the rock amounts to 5,000 gallons per minute.

The workers in the tunnel are supplied with 58,000 cu. ft. of air per minute, spray and ice arrangements being introduced for cooling the air. Shifts change every eight hours. The men are brought out in heated cars and taken to a warm station, where they change their clothes. Ample provision is made for hot and cold douche baths. The workmen's clothing is hung up in hot rooms to dry, in order that it may be in a fit condition for the next day's work. A restaurant is connected with the station, where food of an excellent quality is served at a very small price. Sleeping apartments are also arranged for the men at cost.

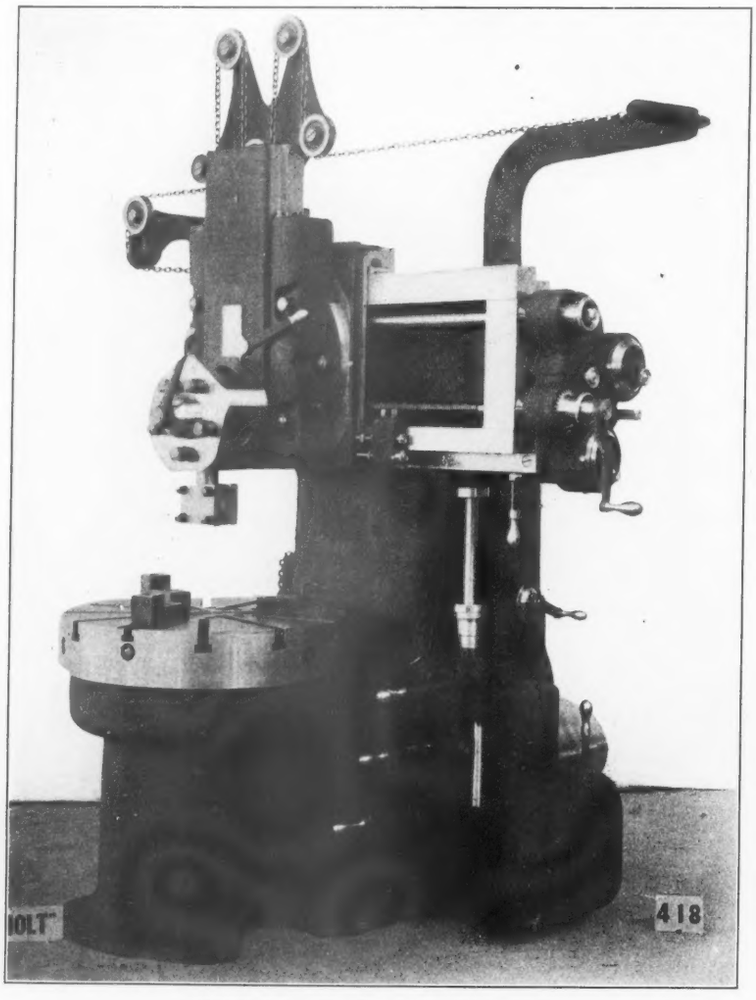
The entire undertaking, which will cost between $18,000,000 and $20,000,000, will consist, when finished, of two parallel single tunnels 56 ft. apart, connected at every 300 ft. by transverse galleries, by means of which one tunnel will ventilate the other.—*U. S. Consular Report.*

The Cunard Steamship Caronia.

The Engineer (London) in a recent issue describes the new Cunarder, Caronia, which is now making her official trial trips. The Caronia is the largest steamship in the world designed primarily for passenger service, as distinguished from the White Star vessels of the Baltic class, which sacrifice speed to large freight carrying capacity. The displacement of the Caronia when fully loaded and drawing 33 ft. is 31,000 tons, comparing with the Minnesota's displacement of 33,000 tons at the same draught. Her length is 675 ft., with 72 ft. beam. The engines are reciprocating, quadruple expansion, driving twin screws, and the cylinders are 39 in., 54½ in., 77 in., and 110 in., respectively, with a piston stroke of 66 in. There are 13 boilers, on the Howden draft system. Eight of them, with double ends, are 15 ft. 2 in. in diameter, with separate combustion chambers to each of the six furnaces, which are 3 ft. 8 in. in diameter. The five single ended boilers are 15 ft. 10 in. in diameter, by 11 ft. 7 in. long. The furnaces of these are 4 ft. in diameter. The Caronia has eight decks, five of which are devoted to passengers, and the boat deck is 67 ft. above the water. The vessel is unique in the Atlantic trade in having accommodations for four classes of passengers, instead of three. The mean speed obtained on two non-official runs was 19¾ knots.

Gisholt 34-in. Vertical Boring Mill.

The latest type of vertical boring mill of the Gisholt Machine Company, Madison, Wis., is shown in the illustration. This machine is of especially stiff construction, all parts being made heavy and rigid. Broad bearing surfaces are provided. There are several essential points of difference between this mill, which is 34 in., and other designs built by this company, the most important being in the headstock. Instead of a friction back-geared headstock, a four-step cone pulley is used, with back gears, thrown in and out by means of a positive clutch operated by a lever. All levers for control of the machine are located conveniently to the operator. The mill is fitted with feed tripping devices similar to those used on larger



Gisholt 34-in. Vertical Boring Mill.

sizes, by means of which any feed may be positively and automatically stopped at any predetermined point. The feed screws are all fitted with micrometer index dials reading to a thousandth of an inch.

The table is made universal with a combination chuck fitted with three movable jaws, or plain with radial T slots and independent jaws, as desired. The two-speed countershaft provides 16 table speeds. Eight changes of feed are provided, all feeds being operated either by power or by hand. The illustration shows the machine with a screw cutting attachment and a swivel turret head. The spindle drive is of the spur or pinion variety, the spindle resting on broad, self-oiling, babbitted surfaces. The machine is also made with a plain head and without the screw cutting attachment.

Compressed Air Power Plants for the Pennsylvania Tunnels.

The compressed air power plants which are now being installed by the Ingersoll-Sergeant Company for S. Pearson & Son and the O'Rourke Engineering & Construction Company, the contractors for the East river and North river sections of the Pennsylvania Railroad tunnels under New York, represent in the aggregate the largest installation of air compressing machinery ever made for general power purposes. The equipment is divided among four power houses at the top of the four shafts from which the tunnels will be driven. The East river tunnels are a work of greater magnitude than those under the North river and the larger units are being placed in the power houses at the shafts in Long Island City and Thirty-second street and First avenue, Manhattan. Preliminary work at the Long Island City shaft is being carried on with a temporary plant consisting of two Ingersoll-Sergeant, Class A compressors having a combined capacity of 1,200 cu. ft. of free air per minute.

The main air compressing plants for the East river tunnels will together include 12 Ingersoll-Sergeant, cross-compound, Corliss, steam-driven compressors with duplex air ends, of the latest type. Of these, eight are to be low pressure units, each with a capacity of 5,000 cu. ft. of free air per minute compressed to 50 lbs. from atmospheric intake. The air from these machines is to be used in the tunnels for keeping out the water and mud as the shields are driven forward. The low pressure air is delivered to the tubes by four 10-in. mains on either side of the river. In addition to these low pressure units there are to be two high pressure compressors of the same general type, but designed to draw their intake either from atmosphere or from the discharge of the low pressure machines. In the first case the capacity of each machine is 1,500 cu. ft. of free air compressed to 100 lbs., and in the second case, it is from 2,000 to 6,600 cu. ft. of free air per minute delivered at pressures up to 150 lbs., depending on the intake pressure. This high pressure air is distributed on the Long Island side through an 8-in. pipe line and on the New York side by a 6-in. main. It is to be used for running rock drills, driving concrete mixing machines, and possibly for pneumatic haulage. The remaining two units of the system are to be combination compressors having steam cylinders of the same size as the machines above described, but, coupled up in tandem to two pairs of duplex high and low pressure air cylinders, of 15½ in. and 22½ in. diameters respectively. Either set of compressing cylinders may be thrown into operation and these combination machines therefore serve the purpose of duplicate or reserve units for either the high or low pressure compressors. The compressors as described are divided equally between the two stations on opposite sides of the river and each power house is served by a battery of five 500-h.p. water-tube boilers delivering steam at 150 lbs. pressure. All these machines are equipped with the Ingersoll-Sergeant positive, air-thrown air valves for both intake and discharge. The engineering details of each plant have been carefully worked out and a great flexibility is provided in the piping and receiver connections by which any compressor or combination of compressors can be made to furnish air to any tunnel. The work of installation of these plants is progressing rapidly. Boiler and engine foundations are completed and one of the large compressors is already in place. The rest are to follow at the rate of one unit per week.

The compressor plant for the North river tunnel work has also been divided into two sections identical in capacity and type; one located at Thirty-second street and Eleventh avenue, New York; the other near Baldwin avenue in Weehawken. Eight compressor units are to be used, four on each side of the river, and all are now installed on their foundations. They are of the steam driven, cross-compound Corliss type with duplex air ends. Six are low pressure machines designed for a terminal pressure of 50 lbs. with atmospheric intake, and having a free air capacity of 4,000 cu. ft. per minute each. The two high pressure compressors of the same type, each having a free air capacity of 920 cu. ft. per minute at a terminal pressure of 100 lbs. from atmospheric intake, or 4,000 cu. ft. per minute from 50 lbs. intake (from the low pressure machines) and a terminal pressure of 150 lbs. The low pressure units have the Ingersoll-Sergeant positive air thrown air inlet and discharge valves; the high pressure machines have piston inlet valves. Three 400-h.p. water-tube boilers on each side of the river furnish steam for the compressing plants at 150 lbs. pressure. The air is to be used for the same purposes and in the same manner as in the East river tunnels.

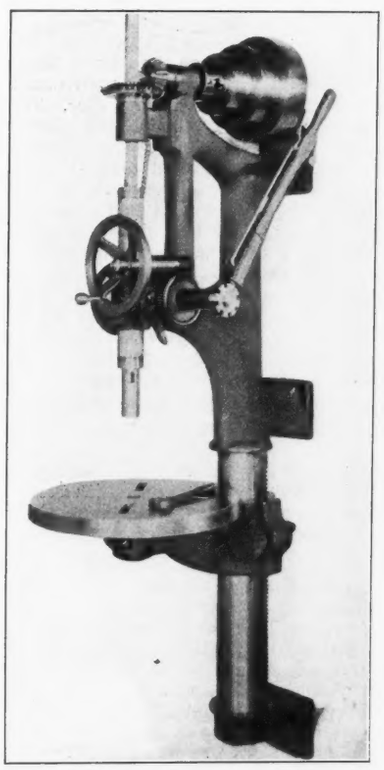
The Metric System.

A report lately issued by the Decimal Association of London announces most satisfactory and encouraging progress since the last report, issued in October, 1903. A bill which had been prepared since that time reached its third reading in the House of Lords and has been sent to the House of Commons. The

prospects for favorable action by the latter are said to be most encouraging. The favorable sentiment in the United States, in the Colonies, and in the trades unions and various trade, industrial and professional circles is recorded, and notice is also taken of the opposition offered in a pamphlet entitled "Against the Metric System" by the late Mr. Herbert Spencer. Reprints of this pamphlet had been distributed last spring and the Decimal Association issued pamphlets in reply to Mr. Spencer's arguments. A campaign of lectures and prize essays was inaugurated during the past year with good results. A growth in the membership of 377 since March 1, 1904, is reported. The total receipts of the association for 1904 were $7,500.

The Boynton & Plumer Post or Wall Drill.

The post drill press shown in the accompanying illustration is made by Boynton & Plumer, Worcester, Mass. This drill is designed to be fastened to the wall or post by brackets which are cast on the upright column. The drill embodies many advantages



Boynton & Plumer Post or Wall Drill.

of the floor drill and at the same time it takes up much less space. It has a swing of 24 in. and the spindle, which is counterbalanced by a weight in the upright column, has a vertical traverse of 11½ in. and is bored with a No. 3 Morse taper socket. The table can be swung around the upright column and it has a vertical traverse of 18 in. operated by rack and pinion. The greatest distance between spindle and table is 24 in.

The machine is equipped with both lever and screw feed, which can be changed instantly from one to the other by a small lever that throws the feed worm in or out of mesh with the worm gear. The lever is arranged with a notched ratchet by which the entire traverse of spindle can be operated with the lever always at a convenient point or angle. This drill has a four-step cone pulley with diameters of 11 in., 8¾ in., 6¼ in., and 4 in. for 2¾-in. belt, and is furnished with countershaft to match. The driving pulleys on the countershaft are 10 in. in diameter for a 3-in. belt and should be run at 230 r.p.m. The entire length of drill is 72 in., and its weight is 610 lbs.

American Railway Appliance Exhibition.

The General Committee of Arrangements of the American Railway Appliance Exhibition, to be held in connection with the International Railway Congress, is emphasizing the fact that the exhibition is to be by no means confined to those who are interested in foreign trade, but will be the best possible opportunity for the makers of supplies designed entirely for use in the United States to bring their manufactures before a remarkably influential gathering of American railroad officers. The committee calls attention to the fact that up to the present time delegates have been appointed to the Congress from railroads in the United States, Canada and Mexico representing a mileage of over 150,000 miles, including practically all the leading railroads. In nearly every instance the delegates chosen include the officials in the mechanical and maintenance of way departments. There will be over 400 accredited delegates to the Congress from American railroads. The committee points out that no equal opportunity to exhibit American railroad appliances to such an aggregation of American railroad officials was ever offered, entirely regardless of whether or not manufacturers are interested in export trade. Even if no exhibit is made, manufacturers are urged to become members of the exhibition, the fee being only $50, which is a small sum to pay for an advertisement which will be given world-wide publicity and for the privileges incident to attendance upon the exhibition. The prominence given to the proposed exhibition by the unprecedented action of the Federal Congress in granting for its use a conspicuous plot of ground in the city of Washington renders it of vital importance to the honor and credit of the supply industry that the exhibition shall be of such proportions as to merit the dignity with which it has been clothed. Announcement is made that one large interest alone has already arranged to put up a building which will cover from 8,000 to 10,000 square feet of ground, while several other interests will erect exhibit buildings covering from 2,000 to 5,000 square feet. The contract for the main building, in which will be housed the smaller and lighter exhibits without power, has been let. The dimensions of this building, which will be a very attractive structure, will be 160 x 200 ft.

Manufacturing and Business.

Bids are wanted March 9 by the Board of Commissioners of the port of New Orleans, La., for building the Henderson street steel shed No. 2. Hugh McCloskey is President.

Chas. W. Cross, formerly of the Roberts & Abbott Co., Consulting Engineers, of Cleveland, Ohio, and later Electrical Engineer for the Eastern Ohio Traction Company, has entered the employ of Crocker-Wheeler Company, of Ampere, N. J., and is attached to the Cleveland office of the company at 816 New England Building.

The New York Continental Jewell Filtration Co. reports recent sales of filters to eight apartment houses, office buildings, etc., and to six mills and miscellaneous plants, including the Bangor Water Works, the Jefferson Laundry, Richmond, Va.; the New England Cotton Yarn Co., Taunton, Mass., and the Angola Dyeing Co., Philadelphia.

John Turnbull, Jr., & Sons, the Glasgow agents for John F. Allen, New York, maker of the Allen riveting machine, gave an interesting and satisfactory demonstration with an 84 in. Allen boiler riveter in a shipyard near Glasgow. The demonstration was witnessed by a number of interested parties, including shipbuilders, boiler makers and a government inspector.

Bids are wanted April 12 by S. D. Griffin, Clerk of the Sanitary District of Chicago, for building the power house of the Lockport Power Development near Lockport, Ill., which is to be a concrete structure about 160 ft. wide, 386 ft. long and 100 ft. high, to contain nine turbine chambers, with bulkheads designed for a working head of 34 ft. of water; a generating room 62 ft. x 359 ft., and offices 20 ft. x 62 ft.

The Northern Electrical Manufacturing Co., Madison, Wis., reports a wide demand for its single-voltage, two-wire, variable-speed motors in many lines of industrial work. Although the largest field is in machine shop work, applications are being made to pumps for boiler feed, circulation, etc., to ventilating and blowing fans, and to elevators, hoists, conveyors, etc. The cement industry has also proven a good field, the variable-speed drive being found especially advantageous.

The India Rubber & Gutta Percha Insulating Company is now offering a "Habirshaw" insulated wire for signal purposes which is claimed to meet the most exacting railroad requirements. The insulation is a Para compound of high electrical resistance yet remarkable elasticity. A piece of the insulation cut from a wire showed an elongation of only 5 per cent. when stretched to 2½ times its length; while at 4½ times its length the permanent elongation was but 12 per cent. Several pieces were stretched to five and six times their length without breaking.

The National Electric Co., Milwaukee, Wis., has secured the contract for the electric generators for the extensions to the Carnegie Institute building at Pittsburg. The installation will consist of five 300 k.w., 12-pole, 125-volt, direct current, engine type generators, running at 120 r.p.m. These machines are to be of the latest design and best material, of massive though pleasing appearance, the heaviness in outline being relieved by the elliptical section of the frame. All visible bolts are to be nickel-plated and the field coils taped on the outside and finished with a wrapping of fish net cord. The terminal boards will be of Vermont marble. The total net weight of each generator will be about 55,000 lbs., the armature and commutator contributing 18,000 lbs. of this. On the final test the generators will be expected to withstand a momentary overload of 75 per cent. without flashing and to operate from no-load to 25 per cent. overload without shifting the brushes.

Iron and Steel.

About 90,223 tons of rails, it is reported, have been ordered by Harriman lines for delivery this year. Of this total, the Union Pacific will receive 23,713 tons of rails; the Oregon Short Line, 17,000 tons; the Pacific system of the Southern Pacific, 43,500 tons, and the Atlantic system, 6,000 tons. Each receives a proportionate quantity of joints.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies see advertising page 24.)

American Society of Mechanical Engineers.

Attention of members is directed to a change of date for the February reunion to Thursday, March 2, instead of February 28, on which it would regularly have fallen. The subject for discussion will be "The Conditions at Panama, and the Reasons for a

Sea Level Canal," with illustrations by Worcester R. Warner, of Cleveland, Ohio, Past President of the society.

Cleveland Railway Club.

The shop and yard forces of the railroads centering in Cleveland recently organized the Cleveland Railway Club, which will hold meetings once a month for the discussion of subjects of interest to the mechanical departments of railroads. The members, to the number of several score, are principally car and locomotive men. The officers for the first year are: William Cottrell (Erie), President; G. M. Bunting (Cleveland & Pittsburg), Vice-President; J. C. Dennerle (Lake Shore & Michigan Southern), Secretary and Treasurer.

Society of Engineers of Eastern New York.

The meeting of this society in Troy February 15, was preceded by an informal dinner at the Rensselaer Hotel, at which 75 members were present, after which an interesting paper on "Modern Ordnance" was presented by Capt. Odus C. Horney, of the Ordnance Dept., U. S. A., Watervliet Arsenal. Thirty-six new members were elected, bringing the membership of the society up to 175. The Nominating Committee presented the following names for officers to be voted upon at the annual meeting April 12: President, Prof. O. H. Landreth, Union College, Schenectady; Vice-President, Capt. Odus C. Horney, Ordnance Dept., U. S. A.; Treasurer, W. I. Slichter, General Electric Co., Schenectady. A. E. Cluett, Secretary.

The Railway Signal Association.

Secretary H. S. Balliet announces that the next meeting of this association will be held at the Great Northern Hotel, Chicago, March 14, at 2 p.m. The discussion of the report of Committee No. 8, "Standard Specifications for Mechanical Interlocking and Material for Construction Work," will be continued, beginning with paragraph 30. This committee desires to make further recommendations at the annual meeting in October. Committee No. 9, on Definitions and Nomenclature, submits for discussion a number of definitions, and the paper on Storage Battery for Block Signals read by Mr. Reynolds at the January meeting, will be offered for further discussion. Members finding it impossible to attend are requested to send to the secretary written opinions on the papers.

PERSONAL.

—The promotion of Mr. William J. Harahan to the office of Fourth Vice-President of the Illinois Central is announced, less than

one year after his promotion to the position of head of the operating department. Mr. Harahan is about 38 years old, and is a native of Nashville, Tenn. He began his railroad career at an early age in the shops of the Louisville & Nashville, of which his father was an officer, and later was made one of the Assistant Engineers. His first engineering work was on the Cumberland & Knoxville Branch of that company. In 1889 he became Engineer of Maintenance of Way on the Chesapeake & Ohio, and after serving in that position for some time he resigned and went to the Baltimore & Ohio Southwestern as Engineer of Bridges, where he remained until 1892, when he went to the Illinois Central as Roadmaster. Then for a short time he was Assistant Superintendent of the Freeport Division, and finally became Superintendent of that Division. In 1896 he was transferred to Louisville as Superintendent of the Louisville Division, from which position he was promoted to be Chief Engineer, and in 1902 was made Assistant General Manager, which position he held until 1904, when he was promoted to succeed Mr. Wallace as General Manager.

—Mr. I. G. Rawn, whose promotion to succeed Mr. Harahan as General Manager of the Illinois Central is announced, has for about a year been Assistant General Manager of that company. Mr. Rawn was born in Delaware, Ohio, 47 years ago, and his first railroad service was as a telegraph operator on the old "Bee Line." In 1888 he went to the Kentucky Central as Master of Transporta-

tion, but resigned the following year to go to the Chesapeake & Ohio as Superintendent and Superintendent of Transportation. In January, 1890, he went to Cincinnati as General Superintendent of the Baltimore & Ohio Southwestern, and he remained with that company until the end of 1902. In December of that year he was transferred to Pittsburg and was made General Superintendent (Baltimore & Ohio), but in less than a year resigned to go to the Illinois Central as General Superintendent of Transportation. In the early part of last year he was promoted to succeed Mr. Harahan as Assistant General Manager, and now again follows the same officer one step higher.

—Mr. J. R. Hitchcock, Superintendent of the Atchison, Topeka & Santa Fe (Coast Lines) at San Bernardino, Cal., has been in railroad service for about 16 years. He began as a messenger in a telegraph office on the Iowa Central. From there he went to the Atchison, Topeka & Santa Fe as timekeeper at San Marcial, N. Mex., and has been connected with the Santa Fe System ever since. He held various positions both in the mechanical and transportation departments, and finally was promoted to be Assistant to the General Manager, from which position he is now again promoted to succeed Mr. Hibbard as Superintendent at San Bernardino.

—Mr. I. L. Hibbard, General Superintendent of the Atchison, Topeka & Santa Fe (Coast Lines), was born in Woodhull, N. Y., in 1857, and has been in railroad service

since 1876. He began on the Erie at Elmira station. From there he went to Boston as a clerk in the general eastern office. Then for three years he served the "Bee Line" at St. Louis as a clerk in the general freight office, and from there went to Forrest, Ill., where he was Trainmaster of the Wabash. Mr. Hibbard resigned from that position in March, 1890, to become Trainmaster at San Bernardino, for the Southern California. In 1897 he was appointed Superintendent of the Albuquerque Division of the Santa Fe at Winslow, Ariz., and six years later was transferred to the Los Angeles Division, from which position he is now promoted to succeed Mr. Shepard as General Superintendent.

—Mr. George H. Webster, whose resignation as Engineer of the Canadian Pacific, was recently announced, is now President and Engineer of the British Columbia General Contract Company of Vancouver, B. C. This company is a branch of the Atlantic, Gulf & Pacific Contract Company of New York.

—Mr. J. J. Bernet, Superintendent of the Eastern Division of the Lake Shore & Michigan Southern, is 37 years old. Mr. Bernet's whole railroad service has been on the Eastern Division of the Lake Shore. He began as a telegraph operator in the Superintendent's office and was successively Train Despatcher, Trainmaster, Assistant Superintendent, and in the early part of this month was promoted to be Superintendent.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe (Coast Lines).—W. H. Brewer has been appointed Assistant to the General Manager, succeeding J. R. Hitchcock.

Atlantic Coast Line.—W. P. Sproul has been appointed Master Mechanic, succeeding F. S. Anthony, resigned.

Canada Atlantic.—E. J. Chamberlin, General Manager, and J. W. Smith, General Assistant, have resigned. It is understood they will engage in railroad contracting, having formed a company to secure contracts.

Canadian Pacific.—J. W. Leonard has been appointed Manager of Construction of the railroad between Sudbury and Toronto. For the present Mr. Leonard's office will be at Toronto.

G. E. Graham has been appointed Superintendent of Terminals at Winnipeg.

Canadian Railway Commission.—A. C. Killam has been appointed Chairman of the Commission in place of A. G. Blair, whose

resignation was announced several months ago.

Chicago, Cincinnati & Louisville.—R. P. Dalton has been appointed Superintendent, succeeding C. L. Nichols.

Chicago, Peoria & St. Louis of Illinois.—M. D. Schaff has been appointed Superintendent, with headquarters at Springfield, Ill.

Central Vermont.—James Coleman, Master Car Builder, having resigned, the title of A. Buchanan, Jr., has been changed to Superintendent of Motive Power and Car Department.

Cleveland, Cincinnati, Chicago & St. Louis.—See New York Central.

Corvallis & Eastern.—T. H. Curtis has been appointed Acting Manager, succeeding E. Stone, deceased.

Denver & Rio Grande.—E. G. Haskins has been appointed Acting Master Mechanic of the Second and Third Division, succeeding A. C. Hinckley.

Denver, Enid & Gulf.—John Overholt having resigned as General Superintendent that office has been abolished and the duties of the Superintendent's office will be handled by the Vice-President and General Manager. B. F. Dunn has been appointed Assistant to the Vice-President and General Manager, with headquarters at Enid, Okla. W. E. McEldowney has been appointed Master Mechanic, with headquarters at Enid.

W. G. Bartlett has been appointed Purchasing Agent, with office at St. Louis, Mo.

Erie.—W. L. Derr, Acting Chief Engineer, has taken charge of the Susquehanna Division as Acting Superintendent, owing to the continued serious illness of W. J. Sharp. It is said that J. L. Stuart is to be appointed Chief Engineer.

Illinois Central.—William J. Harahan, hitherto General Manager, has been appointed Fourth Vice-President. I. G. Rawn, hitherto Assistant General Manager, succeeds Mr. Harahan as General Manager. The position held by Mr. Rawn has been abolished. The position of Assistant General Superintendent of Lines South of the Ohio River has been abolished. H. McCourt, hitherto holding that position has been made General Superintendent of said lines. The position of General Superintendent of Lines North of the Ohio River has been created and F. B. Harriman, who has been Superintendent of the Chicago Division, has been appointed to the position.

Indiana Harbor.—J. H. Snyder has been appointed General Superintendent, with headquarters at Chicago, Ill.

Litchfield & Madison.—T. C. Moorshead has been appointed Superintendent, with headquarters at Edwardsville, Ill.

Louisiana Railway & Navigation Company.—E. Richards has been appointed Assistant Superintendent, with headquarters at Shreveport, La.

Mexican Central.—H. J. Snyder has been appointed Assistant General Freight Agent.

J. J. Kertin, hitherto Trainmaster at Silao, has been appointed Superintendent at Cuernavaca, succeeding R. E. Comfort, resigned.

Michigan Central.—See New York Central.

New York, New Haven & Hartford.—John H. Whittemore has been elected a Director, succeeding the late John M. Hall.

New York Central & Hudson River.—The titles of First, Second, Third, Fourth and Fifth Vice-President of this company, have been abolished, and the officers heretofore known, respectively, by these titles, will hereafter be known simply as Vice-Presidents. With Mr. Guilford, recently appointed, there are now six. Whenever necessary they will be distinguished one from another by adding to the titles the names of the departments of which they severally have charge.

The jurisdiction of J. F. Deems, General Superintendent of Motive Power, Rolling Stock and Machinery, has been extended over the Michigan Central and the Cleveland, Cincinnati, Chicago & St. Louis.

Paris & Great Northern.—H. M. Muchmore, hitherto Division Foreman of the St. Louis & San Francisco at Fort Smith, Ark., has been appointed Master Mechanic of the P. & G. N., with headquarters at Paris, Texas, succeeding C. E. Boss.

Pennsylvania.—D. C. Stewart has been appointed Superintendent of Telegraph, succeeding A. Keiser, who has been appointed Assistant Superintendent of the Pittsburg Division, succeeding Mr. Cooper, transferred to the Superintendency of the Bedford Division, succeeding Mr. George B. Beale. Lewis T. Ford, Superintendent of the Chautauqua Division of the Buffalo & Allegheny Division, has been appointed Superintendent of the Pennsylvania, New York & Long Island (the New York City Tunnel). Mr. Beale is transferred from the Bedford Division to the Buffalo & Allegheny Division.

St. Louis & San Francisco.—See Paris & Great Northern.

Wabash.—H. M. Cryder has been appointed Principal Assistant Engineer, with headquarters at St. Louis, Mo.

LOCOMOTIVE BUILDING.

The St. Louis Southwestern has ordered six locomotives from the American Locomotive Co.

The Japanese Government has ordered 127 locomotives, 77 from the Baldwin Works, and 50 from a Glasgow, Scotland, firm.

The Kansas City, Mexico & Orient has ordered 70 locomotives from the American Locomotive Co. The detail specifications have not yet been made up.

The Buffalo, Rochester & Pittsburg has ordered 20 consolidation (2-8-0) locomotives from the American Locomotive Co. in addition to the five reported in our issue of December 2.

The Vulcan Iron Works, of Wilkesbarre, Pa., have recently shipped six 9 in. x 14 in. contractors' locomotives to Reilly & Webber, of Hollidaysburg, Pa.; four 10 in. x 16 in. to Porter Bros., Duluth, Minn.; two 7 in. x 12 ft., 24 in. gage, to the Illinois Tunnel Co., Chicago, Ill.; two 9 in. x 14 in., 36 in. gage, to Henry A. Whitley, San Francisco, Cal., and one 10 in. x 16 in. to Erickson & Peterson, San Francisco, Cal. They also have orders for export locomotives for Honolulu, Porto Rico, Honduras and Cuba.

The Norfolk & Western, as reported in our issue of January 27, has ordered 18 consolidation (2-8-0) (class W) freight locomotives, nine from the Baldwin Works and nine from the American Locomotive Co. These locomotives will have the same specifications as the consolidation (class W) locomotive placed on exhibition in St. Louis, specifications for which are as follows: Total weight of engine, 173,790 lbs.; weight on drivers, 151,490 lbs.; weight on front truck, 22,300 lbs.; total weight, engine and tender, 290,000 lbs.; driving wheel base, 15 ft. 6 in.; total engine wheel base, 23 ft. 11 in.; total wheel base, engine and tender, 51 ft. 2 in.; length over all, 60 ft. 5 in.; height, rail to center line, 8 ft. 6 in.; diameter of drivers, 56 in.; cylinders, 21 in. x 30 in.; radial stayed wagon-top steel boiler, 64 in. in diameter, with a working steam pressure of 200 lbs.; firebox, 101 in. x 64½ in.; 252 charcoal iron tubes, 2¼ in. in diameter and 14 ft. 6 in. long; heating surface, firebox, 160.4 sq. ft.; heating surface, tubes, 2,140 sq. ft.; total heating surface, 2,300.4 sq. ft.; grate area, 45 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, 10 tons. The special equipment includes: Franklin boiler lagging, Central Iron & Steel Co.'s boiler steel, Solid Steel Casting Co.'s 50 in. driving wheel centers, Standard Steel Works truck wheels, Westinghouse friction draft gear, Nathan injectors and sight-feed lubricators, United States metallic piston and valve rod packing, Latrobe pilot coupler, Ashton safety valve, and American Locomotive Sander Co.'s sanding apparatus.

The Wabash-Pittsburg Terminal, as reported in our issues of January 20 and February 10, has ordered six simple Atlantic-type (4-4-2) passenger locomotives from the Dunkirk Works of the American Locomotive Co., and six simple switching (0-6-0) locomotives from the Rogers Works of the American Locomotive Co. The complete specifications are as follows: The Atlantic-type locomotives are to weigh 181,000 lbs., with 97,000 lbs. on drivers; weight of tender, 130,000 lbs.; cylinders, 21 in. x 26 in.; diameter of drivers, 79 in.; diameter of trailers, 51 in.; radial stayed extended wagon-top boiler, with a working steam pressure of 200 lbs.; total heating surface, 2,675.26 sq. ft.; 294 National Tube Co.'s iron tubes, 2 in. in diameter and 16 ft. 4 in. long; firebox, 102 in. x 63 in.; grate area, 43.71 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, 12 tons. The special equipment will include: Westinghouse high-speed air-brakes, steel axles, Wabash standard bell ringer, Franklin sectional boiler lagging, Damascus brake-beams, iron brake-shoes, Tower couplers, Pyle electric headlights, Nathan injectors and sight-feed lubricators, Ajax plastic bronze journal bearings, Jerome piston rod packings, American Locomotive Co.'s valve rod packings, Ashton safety valves, Leach and gravity sanding devices, Scott springs, Ashcroft steam gages, Latrobe driving wheel, truck wheel and tender wheel tires; 72-in. cast-steel wheel centers, Barnes drifting valve, Elvin driving box lubricator, McCord journal boxes and Anaconda water hose. The switching locomotives are to weigh 143,000 lbs., with tender 231,565 lbs.; cylinders, 19 in. x 28 in.; diameter of drivers, 57 in.; radial stayed straight boiler, with a working steam pressure of 190 lbs.; heating surface, 1,681.9 sq. ft.; 288 National Tube Co.'s iron tubes, 2 in. in diameter and 10 ft. $10^{9}/_{16}$ in. long; firebox, 108 in. x 39⅝ in.; grate area, 32.45 sq. ft.; tank capacity, 4,500 gallons, and coal capacity, six tons. The special equipment will include: Westinghouse automatic straight air-brakes, steel axles, Wabash standard bell ringers, Franklin sectional asbestos boiler lagging, Damascus brake-beams, iron brake-shoes, Gould couplers, Wabash standard headlights, Ohio injectors, Ajax plastic bronze journal bearings, Jerome piston and valve rod packings, Ashton safety valves, Leach and gravity sanding devices, Chicago sight-feed lubricators, Scott springs, Ashton steam gages, standard driving wheel tires, 50-in. steel wheel centers, Otis boiler steel, Champion rivets, McCord journal boxes, Anaconda water hose and Peerless air-brake hose.

CAR BUILDING.

The Atchison, Topeka & Santa Fe is reported to have ordered 60 passenger cars and 5,300 freight cars.

The St. Louis & San Francisco has ordered 17 additional box cars from the American Car & Foundry Co. to replace cars belonging to equipment trusts.

The J. G. Brill Company is reported to have received orders for cars from the Zanzibar Railroad, the Cape Government Tramways of Cape Colony, the Companhia Carris de Ferro Do Porto of Portugal, the British Columbia Electric Railway, of Vancouver, and from Bolivia.

The Southern Indiana has ordered 250 34-ft. dump cars of 60,000 lbs. capacity from Barney & Smith for March delivery. The special equipment will include: Simplex bolsters, Monarch brake-beams, Walsh brake-shoes, Tower couplers, solid draft rigging and Diamond trucks.

The Norfolk & Western has ordered 500 steel-frame box cars of 80,000 lbs. capacity from the Pressed Steel Car Co. The company will also build 300 hopper-bottom gondolas of 100,000 lbs. capacity, with wooden sides and steel underframes, at its Roanoke shops, in addition to the 200 reported in our issue

of January 6. The company has also ordered from the Wilmington Works of the American Car & Foundry Co., 10 passenger coaches, five baggage and mail cars and five baggage and express cars, as reported in our issue of February 17. The coaches will have the same specifications as the 20 ordered from the Pullman Co. and reported in our issue of July 29. The baggage cars will have the same specifications as those ordered from Harlan & Hollingsworth, specifications for which were reported in our issue of September 2.

BRIDGE BUILDING.

Bridgeport, Conn.—Bids may soon be asked by A. B. Hill, New Haven, Conn., for building a reinforced 40-ft. concrete arch and approaches over Ash creek between this place and Fairfield, to cost between $20,000 and $25,000. H. G. Scofield is City Surveyor.

Cedar Rapids, Iowa.—The City Council has passed a resolution to build a concrete bridge over Cedar river at a cost of about $75,000. T. H. McCauley is City Engineer.

Chicago, Ill.—Plans are reported completed for building a bascule bridge at North avenue, for which bids will soon be asked.

Columbia, Pa.—The Standard Oil Co., it is reported, will spend about $100,000 in building the proposed bridge over the Susquenanna river at York Furnace, on condition that it is permitted to run a pipe line over the structure.

Des Moines, Iowa.—Plans have been completed by City Engineer Budd for two additional arches for the Sixth avenue bridge, to cost about $40,000.

Elk River, Minn.—Bids are wanted March 11 at the office of the Village Recorder for building a steel bridge with steel approaches, with a roadway of 18 ft. over the Mississippi river between this place and the town of Otsego; also for the substructure. A. H. Nickerson is President of the Village Council.

Elmira, N. Y.—Bids may soon be asked by the Mayor for building a steel bridge 300 ft. long over the Chemung river, to cost $55,000. E. D. Burgen is Deputy Clerk.

Goderich, Ont.—The county council will build the following steel bridges during the summer: On the nine-mile creek, two miles south of Lucknow; on the Matiland river, known as Morris Bank bridge and on the Bayfield river, known as Maccan's bridge.

Harrisburg, Pa.—Bids are wanted February 28 by J. M. Shoemaker for building the substructure and superstructure of a highway bridge over Penn's creek.

Mitchell, Ont.—Two steel bridges will be built in the township of Grey.

Paisley, Ont.—Greenock township council will shortly call for bids for rebuilding Watson's bridge, steel superstructure on concrete abutments. It may be necessary also to rebuild the Riverside bridge and another bridge 300 feet long on the 18th concession.

Pocahontas, Ark.—Bids will be asked some time in April by B. A. Brown, County Judge, for building an iron and stone bridge over Eleven Point river. B. F. Spekes is County Clerk.

Providence, R. I.—Bids are wanted March 22 by the Board of Commissioners for building the approaches of the Rhode Island stone bridge to consist of masonry walls and arches with roadbed, with a total length of 1,625 ft., including a draw, for which bids are asked separately on the same date. Charles Alexander is a commissioner.

Scranton, Pa.—This city may join with the Scranton Railway Co. in building a bridge over the railroad tracks and the Lackawanna river at the foot of Mulberry street.

Shreveport, La.—The St. Louis Southwestern has given a contract to the Missouri Valley Bridge Co. for building the piers of its new bridge over the Red river at this place. The bridge is to be 1,250 ft. long with six spans and a draw.

Shamokin, Pa.—Petition nas been made to the County Commissioners to build a bridge over Shamokin creek at Arch street. A bridge may also be built at Mulberry street.

Stella, Wash.—Bids are wanted March 3 by F. G. Barnes, County Commissioner, at Kalama, for building an iron bridge 186 ft. long over Coal creek in Cowlitz County.

Steubenville, Ohio.—A bridge is proposed over the Ohio river to cost about $80,000.

Sunbury, Pa.—The Sunbury Bridge Co. and the Sunbury & Selinsgrove Electric Railway, at a recent meeting, decided to build a bridge to carry electric cars over the river at this place.

Towanda, Pa.—The court has consented to the building of a bridge over the Susquehanna river at Stores ferry.

Tazewell, Tenn.—A steel bridge of three spans will be built over the Powell river by Claiborne County Commissioners; bids will soon be asked.

Tuckersmith, Ont.—A 90-foot steel bridge on concrete abutments will be built over the Bayfield river. Address A. G. Smillie, this place.

Washington, D. C.—Plans, it is reported, have been approved by the District Commissioner for the Baltimore & Ohio bridge to be built at New York avenue, northeast. The bridge is to be 600 ft. long, of steel and concrete, and will cost about $175,000.

Worcester, Mass.—A bill has been introduced in the State Legislature directing the County Commissioners to build a bridge over Lake Quinsigamond, at a cost of about $125,000.

Williamsport, Pa.—Viewers report in favor of a plate girder bridge 42 ft. wide over Hagerman's run at East Central avenue.

Other Structures.

Albuquerque, N. Mex.—The Atchison, Topeka & Santa Fe, it is reported, will build additions to its shops at this place at an expense of about $65,000 and make other improvements, making the total cost of the work about $100,000.

Auburn, N. Y.—The New York Central, it is reported, will begin work on a new passenger station early in March.

Charleston, S. C.—It is said that the Atlantic Coast Line and the Southern will jointly build a union passenger station.

Clyde, Ill.—The Chicago, Burlington & Quincy, it is said, will put up a roundhouse.

Columbus, Ga.—The Southern, it is reported, will put up a large freight house to cost about $50,000.

Fairbury, Ill.—The Toledo, Peoria & Western is planning to put up a new passenger station to cost about $20,000.

Hornellsville, Pa.—According to local reports, the Erie will spend $150,000 repairing its shops at this place.

Ida Grove, Iowa.—The Chicago & North Western, local reports state, has announced that it will build a new passenger station on Second street to cost about $20,000.

Jamestown, N. Dak.—The Northern Pacific, it is reported, will put up a passenger station to cost $60,000.

Marshall, Tex.—The Texas & Pacific, it is reported, will spend $25,000 in improvements at its shops.

Paris, Ill.—The Vandalia, local reports state, will build a new passenger station to cost $20,000.

Pittsburg, Pa.—The Baltimore & Ohio, it is reported, will spend about $80,000 for a number of small stations to be built in Pennsylvania, West Virginia and Ohio.

Portland, Ore.—A contract has been given by the Northern Pacific Terminal Co. for putting up umbrella sheds over the tracks at the union station.

Provo, Utah.—The San Pedro and the Rio Grande are considering a plan for putting up a brick station to cost about $25,000, together with freight yards, sheds and other improvements, at an aggregate cost of $80,000.

Sioux City, Iowa.—The Great Northern, according to reports, is planning to put up a passenger station at Third and Fourth streets to cost about $125,000.

Syracuse, N. Y.—Plans are being made by the Delaware, Lackawanna & Western for improvements to cost $75,000, to include a new roundhouse, rearranging the yards and a new coal elevator.

Waco, Tex.—The St. Louis Southwestern, local reports state, has plans ready for putting up a new passenger station at Fourth street, to cost $50,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Arizona Southern.—This company's line from Red Rock, Ariz., to Silverbell, 21 miles, where the mines of the Imperial Copper Co. are located, is now in operation. A. N. Gage, of Tombstone, Ariz., is Treasurer. (April 8, p. 281.)

Alaska Midland.—This company has been incorporated in the state of Washington with a capital of $5,000,000. Robert Moran, Jacob Furth and R. A. Ballinger are among the incorporators.

Baltimore & Ohio.—This company is reported to be relaying about 15 miles of double track east of Bakerstown on the old Pittsburg & Western with 85-lb. rails.

Bangor & Northern Maine Short Line.—A bill has been introduced in the Maine legislature to incorporate this company to build a railroad from tidewater in the city of Bangor through Lagrange, Mattamiscontis, Medway and unorganized townships to Millinocket; also from a point in Mattawamkeag through Moluncus, Macwahoe, Reed and Glenwood plantations and the towns of Amity and Hodgdon into the town of Houlton, with a branch through Stacyville, Patten and unorganized townships to Presque Isle. Herbert M. Heath, of Augusta; George W. Maxfield, of Bangor, and Edward C. Stokes, of Trenton, N. J., are among the incorporators.

Bellingham Bay & British Columbia.—Local reports state that this road, which now runs from Bellingham Bay, Wash., north to Sumas, 22 miles, and from Sumas east to Glacier 22 miles, will build from Sumas west to Blaine, in the northwest corner of Washington, 20 miles, at which point the company has recently purchased six blocks of tidewater lands at the mouth of Dakota Creek.

Belt Line Railroad.—L. D. Kinney, President, Marshfield, Ore., is quoted as saying that this road will have 29 miles of main track extending from North Bend, on Coos bay, Coos County, Ore., through Empire and Marshfield to Glasgo. Surveys will be made this year.

Boston, Pawtucket & Providence (Electric).—The Boston & Suburban and the Boston & Worcester electric companies are reported to be interested in a new corporation under this name which proposes to build an air line high-speed electric road extending from the Forest Hills terminal of the Boston Elevated Railroad to the Rhode Island boundary, and thence through Pawtucket to Providence.

Canadian Pacific.—This company will double track its line between Winnipeg and Fort William, 419 miles, for which surveys are now being made. A cut-off will be built from Winnipeg to Molson, Man.

Work on the following extensions is reported under way: From Brookdale to Varcoe, 18 miles; from Lipton to Strassburg, 40 miles.

Canyon City & Great Northern.—Officers of this company, which was incorporated

about a year ago, express the intention of soon beginning construction. The proposed line is from the Cuckoo coal fields near Florence, Colo., to El Paso, Tex., 760 miles.

CHEROKEE, SPARTANBURG & UNION (ELECTRIC).—A bill has been introduced in the South Carolina Legislature to incorporate this company with a capital of $250,000 to build an electric road connecting Union, Spartanburg and Gaffney, S. C., and Asheville, N. C. A. N. Wood and T. B. Butler, of Gaffney, and John B. Cleveland and W. H. Hamrick, of Spartanburg, are incorporators.

COAL & COKE.—An officer writes that this company's line, which is to run from Elkins, W. Va., via Sago, Burnsville and Gassaway to Charleston, 173 miles, is completed from Elkins to Sago, 23 miles, and in operation as far as Bellington, 18 miles; and on the southern end, from Gassaway to Charleston, 92 miles. The building of the rest of the line is under contract to McArthur Bros., of Chicago; Furgurson Contracting Co., of Pittsburg, and Joe Fucco, of Weston, W. Va. There will be 5,800 ft. of tunnels and 30 steel bridges on the entire line. A. A. Chapman, of Weston, W. Va., is Chief Engineer.

COLORADO, COLUMBUS & MEXICAN.—This company is reported to have been incorporated in New Mexico to build a road from Salt Lake City, Utah, to Monterey, Mex.

COLORADO ROADS.—It is reported that the Great Western Coal Co., of Florence, Colo., will build a road from its coal lands in Fremont County to Colorado Springs, 50 miles. F. D. Keith, of Canyon City, is interested.

DELAWARE & HUDSON.—Press reports state that this company will build a spur of its road, which will be operated by electricity, through Water street, Albany, and along the Hudson River front through the lumber yards district.

DENVER & GREAT WESTERN.—A contract is reported to have been let to J. A. Osurr for building a six mile extension of this road, now eight miles long, connecting the sugar factories of Fort Collins, Winsor, Longmont and Lovell, Colorado.

DENVER & KANSAS NORTHERN.—An officer writes that this company, which proposes to build six lines in northwestern Kansas of an estimated aggregate length of about 1,400 miles, plans to begin grading about August on a line from Stockton, Kan., via Hill City southwest to Scott, 125 miles.

DULUTH & NORTHEASTERN.—The extension of this road from Island Lake, Minn., on the Cloquet river, to Cloquet, on the St. Louis river, 25 miles, has been finished and the road is now in operation from Hornby, on the Duluth & Iron Range, to Cloquet, 57 miles, with 28 miles of branches.

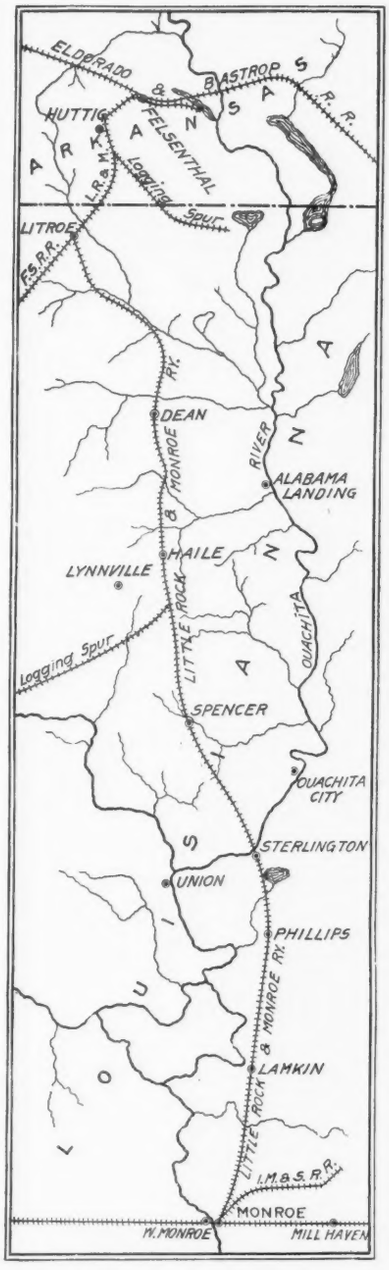
EL PASO, MOUNTAIN PARK & ST. LOUIS.—This company, which was lately incorporated in Oklahoma, has, it is reported, surveyed 110 miles of its proposed route from Oklahoma City to Mountain Park, Okla., and right of way has been secured for this distance. R. K. Keeley, of Mountain Park, is President. The line is projected to be 1,700 miles long from St. Louis, Mo., to Guaymas, Mex. (October 28, p. 139.)

GEORGIAN BAY & SEABOARD (CANADIAN PACIFIC).—Authority is being asked from the Dominion Government by the Canadian Pacific to incorporate this road, with a capital stock of $500,000, to build from a point on Georgian Bay between Port Severn and Penetanguishene, southeasterly through Simcoe, Ontario, Victoria, Peterborough, Hastings, Lennox, Addington, Frontenac and Lanark counties to a connection with the Ontario & Quebec. W. D. Matthews, H. C. Hammond and Henry Beatty, of Toronto, are incorporators.

GOLDFIELD RAILROAD.—This road, which is to run from Tonapah, Nev., via Columbia to Goldfield, 31 miles, is under contract to McLean & McSweeney, of Tonopah. Work is to be immediately begun and to be completed in June. R. W. Welsh is Chief Engineer. See Tonopah below.

GREAT NORTHERN OF GUATEMALA.—It is reported that this company, in which Sir William Van Horne is interested, is rebuilding its line from Puerto Barrios to a point about 100 miles in the interior, and that the road will eventually be extended to Guatemala City.

GULF & CHICAGO (MOBILE, JACKSON & KANSAS CITY).—An officer writes that this road, which is to run from Newton, Miss., via Ackerman and Houston, Miss., to Pontotoc, 143 miles, has all been graded and track has been laid from Ackerman to Noxapater, 30 miles, and from Houston to Pontotoc, 25 miles. F. W. Johnston & Co., of Bay City, Tex., have the contract for track laying, and the Jarrett Construction Co., of Springfield, Mo., for buildings. (See Mobile, Jackson & Kansas City, June 24, p. 15.)



Little Rock & Monroe.

IMBODEN & ODELL.—An officer writes that the proposed route of this road is from Charleston, W. Va., via Blue Creek Station, Coco, Quick and Pond Gap to Summerville, W. Va., 44 miles. The section from Blue Creek to Quick, 10 miles, is under contract to T. J. Carmack, of Charleston, W. Va. Grading on this section is completed and track is laid two miles out of Blue Creek station. Bids will be received until March 1 by C. P. Peyton, Charleston, W. Va., Chief Engineer, for building eleven miles of road on Blue Creek. Five tunnels will be required on the entire line.

INDIANA HARBOR.—An officer writes that surveys are being completed for an extension of this road, which now has in operation a belt line around the city of Chicago, Ill., and a line from Indiana Harbor, Ind., south to Osborn, 6 miles. The extension is to run from Osborn through Lake, Newton, Benton and Warren counties, in Indiana, via Hartsdale and Kentland to Danville, Ill., 101 miles. The right of way for the northern part of the line has been acquired, and construction work is to begin early this spring. C. W. Hotchkiss, 401 La Salle street, Chicago, is President. (See Construction Supplement.)

INDIANAPOLIS, DANVILLE & ROCKVILLE.—This company, whose line is projected from Indianapolis, Ind., to Rockville, 60 miles, has completed 17 miles from Indianapolis to Danville. (See Construction Supplement.)

INTERBOROUGH.—This company has made application for authority to build a subway from Fourteenth street and Union square, New York City, up Broadway to Forty-second street. This line would make the third side of a triangle, with the present line up Fourth avenue from Fourteenth street to Forty-second street as one of the other sides, and from Park avenue and Forty-second street under Forty-second street to Broadway as the other.

LITTLE ROCK & MONROE.—This road is practically completed from Felsenthal, Ark., on the El Dorado & Bastrop, south across the Louisiana state line to Monroe, 45 miles. The line penetrates a rich timber district. W. B. Arnold, Huttig, Ark., is General Superintendent.

LOUISVILLE & NASHVILLE.—The contract for building a 10-mile extension of the Norton branch from Artemus, Ky., to the mines of the Cumberland Coal Co. has been let to Eddington, Griffith & Gronner, of Knoxville, Tenn.

MILWAUKEE & STATE LINE.—This company has been incorporated in Wisconsin with a capital of $10,000 to build from the city of Milwaukee through Milwaukee, Racine and Kenosha counties to the State line. Charles L. Lowe and John M. Mariga, of Chicago, are incorporators. The company is reported to be organized in the interests of the Chicago & North Western.

MISSISSIPPI, ARKANSAS & WESTERN.—This company, whose road is in operation from Blissville, Ark., to Vinson, 12 miles, and built to Big Bayou, proposes an extension from Big Bayou to Gaines Landing, 10 miles.

MISSOURI, KANSAS & TEXAS.—This company, it is reported, has made large purchases of land in Kansas City, Mo., for use as freight yards. This action is taken in consequence of the termination of the contract by which it has used the St. Louis & San Francisco's freight houses and yards at Kansas City.

MOHAWK VALLEY.—This company has been incorporated at Albany, N. Y., with power to build railroads, to organize other corporations, and to buy, hold and dispose of stocks and bonds of other corporatons. The incorporators and directors are: William A. Greer, Assistant Treasurer of the New York Central & Hudson River; Landreth H. King, Registrar of Contracts of the same road; William S. Barger, of Rhode Island; Frederick H. Meeder, of New York; Charles H. Chambers, of White Plains, and William S. Langford, of Yonkers, all of whom are connected with the New York Central. It is believed that the Mohawk Valley is to be a holding company for the electric railway properties of which the New York Central and the Delaware & Hudson are interested.

New York, Auburn & Lansing.—This company, which proposes to build from Auburn, N. Y., south to Ithaca, 32 miles, is reported to have applied to the New York State Railroad Commissioners for authority to issue a mortgage of $1,000,000 and for permission to cross the tracks of the Lehigh Valley.

Oakland & East Side (A., T. & S. F.).—This short line from Richmond, Cal., via Berkeley to Oakland, 11.32 miles, is now in operation. (See Construction Supplement.)

Ohio River & Columbus Valley.—An officer is quoted as saying that this road, which now runs from Sardinia south to Ripley, 24 miles, will be extended from Ripley southeast to Aberdeen, 10 miles.

Oregon State Portage Railroad.—It is reported that the contract for building this road, which is to run from Celilo to Big Eddy, 8½ miles, has been let to Nelson & White, The Dalles, Ore. The State of Oregon is to supply rails and rolling stock and the contractor to furnish the rest of the material. A coaling station, one roundhouse, one water tank, 75 tons of structural material, and 50,000 cu. yds. of embankment will be required.

Portland, Nehalem & Tillamook.—A bill has been introduced in the Oregon legislature requiring railroads to interchange cars and establish rates for joint traffic into terminals, and press reports indicate that its object is to secure an entrance to Portland for this company over some existing line.

Red River Valley (Electric).—An order is reported to have been placed with the Westinghouse Co. of Pittsburg for machinery for an electric road from Clintonville, Wis., through Eland Junction, Matton and Phlox to Antigo, 80 miles. The road is projected to be extended later to the mining region at Republic, Mich.

Rockford Belt.—This company has filed articles of incorporation in Illinois to build a belt line in the city of Rockford, Ill., and nine diverging lines from the city of Rockford, one of which will go to Freeport. The capital stock of the company is $100,000, and the incorporators, B. Lee, S. F. Andrews, A. P. Humburt, F. L. DeLay and C. E. Feineich, all of Chicago.

Scranton, Factoryville & Tunkhannock (Electric).—This company, whose line is projected to run from Scranton northwest through Clark's Summit, Waverly, Dalton and Factoryville to Tunkhannock, 25 miles, with branches to Lake Winola and Lake Carey, has filed a mortgage for $2,000,000 to the Imperial Trust Co., of Jersey City. James P. Dixon and Charles D. Sanderson, of Scranton, are reported to be interested.

Silverton Northern.—The Animas Forks extension of this road from Eureka, Cal., to Animas Forks, four miles, is now completed. The company proposes an extension of the Cunningham Gulch branch from Howardsville to Green Mountain, 1½ miles. This has been surveyed and grading is to be begun in May.

Southern Pacific.—The following new lines have been completed during the past year: The Inter-California extension from Old Beach via Imperial to Calexico, on the international boundary line between the United States and Mexico, 41.36 miles; grading of the yards at Montello, Nev.; relocation of the line between Strauss and Rio Grande, in New Mexico; Ogden-Lucin cut-off; extension from Mallard Junction, La., to Lake Arthur, 34 miles; second track from Lawrence, Cal., east to Santa Clara. (See Construction Supplement.)

Southport & Northwestern.—A charter has been granted in North Carolina, under which, it is reported, the Waccamaw Land & Lumber Co. will build a line from Southport via Whiteville to Sanford. The authorized capital stock is $2,000,000. John D. Bellamy, of Wilmington, N. C., is interested.

Texas Roads.—A railroad is being built from Kirbyville, Tex., to De Ridder, La., 30 miles. The right of way has been obtained from Kirbyville to the Louisiana line and grading has been begun.

Texas Southeastern.—This company, whose road runs from Diboll, Tex., to Diboll Junction, 13 miles, is reported to have let a contract to Charles McSweeney, Houston, Tex., for grading a nine-mile extension.

Tidewater.—An officer writes that this company's line, which is projected to run from the western boundary of Virginia via Roanoke to Hampton Roads, 350 miles, has all been surveyed, and that contracts will soon be let. William N. Page, Ansted, W. Va., who is Chief Engineer of the Deepwater Railway, is President.

Tonopah.—An officer writes that this line from Rhodes, Nev., to Tonopah, 61 miles, which was completed last July and is 36-in. gage, will be made standard gage, work to be completed in June. This, with the Goldfield Railroad, referred to above, will make a through line from Rhodes via Tonopah to Goldfield, 92 miles. R. W. Welsh is Chief Engineer. (April 29, p. 336.)

Trans-Alaska Railroad.—A bill has been introduced in the United States Senate to incorporate this company with a capital stock of $10,000,000, and to have the Federal Government guarantee the interest on its bonds at a rate not exceeding 4 per cent. to the extent of $40,000 a mile. The projected route of the line is from Valdez, on the Copper River, northeast to Eagle City, on the Yukon River, 500 miles. The incorporators are Henry Bratnober, of California; Charles F. Manderson, of Nebraska; George W. Holdrege, of Nebraska; George C. Hazelet, of Alaska, and William Tod, of New York.

Union Pacific.—This company, it is reported, will extend to Altamont its branch which runs from Kemmerer, Wyoming, to Cumberland. Altamont is on the main line west of the Spring Valley tunnel.

Vancouver, Victoria & Eastern (Great Northern).—An officer writes that grading is completed on the extension from Grand Forks, B. C., northwest to Phoenix, 24 miles, with a branch to Granby Smelter, 6½ miles. Porter Bros., of Phoenix, B. C., have the contract for the track laying and bridges. An extension is proposed from Midway, B. C., to Oroville, Wash. James H. Kennedy is Chief Engineer.

Wisconsin Central.—Press reports state that this company has finished a survey for an extension of its Portage branch to Lake Ennis, Wis., where a large cement plant is to be built by the Wisconsin Portland Cement Co.

RAILROAD CORPORATION NEWS.

Atlantic & Birmingham.—Baker, Ayling & Co., of Boston, have purchased and are offering for sale $601,000 first-mortgage 5 per cent. bonds of 1904 issued for improvements in the terminal facilities of this road at Brunswick, Ga. This makes $4,090,000 of the issue outstanding. The bonds are a first lien on 337 miles of road, including the Brunswick & Birmingham, recently acquired.

Boston & Maine.—The $3,660,000 Fitchburg 4 per cent. bonds recently sold to Jackson & Curtis, of Boston, and Clark, Dodge & Co., of New York, will complete the new capital expenditures of the Boston & Maine system for the present. The proceeds from the sale will be used to refund part of the issue of $3,932,000 short-term notes maturing from February 15 to May 2, 1905, which were issued to finance the bonds of the Fitchburg and Vermont & Massachusetts railroads maturing in 1903 and 1904. The only other securities of the Boston & Maine system which mature this year are $500,000 Boston & Lowell 4 per cent. bonds due September 1. The Boston & Lowell has already applied to the Massachusetts Railroad Commissioners for authority to issue $500,000 bonds for refunding purposes. This issue has already been sold and will not come on the market.

Buffalo & Susquehanna.—This company has recently made a trackage agreement with the Buffalo, Rochester & Pittsburg, whereby it will use the latter company's tracks between Stanley, near the western boundary of Clearfield County, Pa., and Juneau, on the northern line of Indiana County, a distance of about 15 miles. This will give the Buffalo & Susquehanna immediate access to its extensive coal lands at Sykesville, Big Run and Troutville. It is stated that from Juneau the Buffalo & Susquehanna will build its own road southwest to Plumville, 15 miles, where a tract containing, it is said, about 55,000,000 tons of coal is owned. Arrangements have been made to finance this extension and to provide funds for the immediate development of these coal properties.

Central New England (N. Y., N. H. & H.).—This company's gross receipts for the quarter ending December 31 were $279,612, against $176,136 for the same quarter in 1903, an increase of $103,476. The net earnings were $5,075, against a deficit of $15,615 in 1903.

Chicago, Milwaukee & St. Paul.—The La Crosse & Onalaska Short Line, which runs from LaCrosse, Wis., to Onalaska, 3.76 miles, has, it is reported, been sold to the Chicago, Milwaukee & St. Paul.

Missouri, Kansas & Texas.—The December statement of this company shows gross earnings of $10,917,506 for the six months ending Dec. 31, 1904, as compared with $9,640,525 for the corresponding period in 1903, an increase of $1,276,981. Operating expenses and taxes for the same period increased from $6,763,072 in 1903 to $7,527,310 in 1904, an increase of $764,238. Net earnings increased from $2,877,452 to $3,390,196, an increase of $512,744. Interest on bonds and rentals increased from $1,961,470 to $2,112,874, leaving an increase in the surplus of $361,339.

Missouri Pacific.—Kuhn, Loeb & Co. are offering at 95 an unsold portion of the $25,000,000 present issue of 40-year gold bonds of 1954.

Muscatine North & South.—Articles of reincorporation of this company, which was sold at foreclosure on December 15, have been filed in Iowa. The new company will have its headquarters at Muscatine and an authorized capital of $450,000. John Graham, Joseph B. Clark and Percy H. Clark are incorporators and directors. The road, which runs from Muscatine south to Elrick Junction, 29 miles, was sold under an order of the United States court to satisfy a judgment in foreclosure proceedings brought by the New York Security & Trust Co., which was trustee for the mortgage bonds of the road.

New York Central & Hudson River.—The statement of this company and leased lines for the month of January, 1905, shows earnings from operation of $6,044,558, as compared with $5,380,746, for the same month of 1904, an increase of $663,712.

Seaboard Air Line.—It is announced that over 80 per cent. of the stockholders have assented to the plan of the Ryan-Blair committee for the reorganization of this company. The committee has decided to extend until March 11 the time within which certificates may be deposited in support of the plan.

Texas Southern.—This road, which runs from Marshall, Tex., to Winnsboro, 24 miles, and which went into the hands of a receiver last year, has been ordered to be sold at foreclosure sale on August 1, $300,000 being the minimum bid recognized. S. P. Jones, the receiver of the company, has been directed by the court to issue $150,000 of receiver's certificates.

Wabash-Pittsburg Terminal.—Application has been made to the New York Stock Exchange to list $25,000,000 Wabash-Pittsburg Terminal first-mortgage 4 p. c. 50-year gold bonds of 1954 and $20,000,000 second-mortgage 4 per cent. 50-year gold bonds of 1954.